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**Communicating projections to users**

# Key recommendations and good practices in the communication of population projections.

### Preliminary report of the Task Force on population projections [1]

## Acknowledgements

The present report has been prepared by the UNECE Task Force on Population Projections, which consisted of the following members: Patrice Dion (Statistics Canada, chair of the Task Force), Suzanne Dunsmith (Office for National Statistics, United Kingdom), Nora Galbraith (Statistics Canada), Victor Garcia Vilchis and Felix Velez Fernandez Varez (INEGI, Mexico), Mehmet Dogu Karakaya (TurkStat, Turkey), Raymond Kohli (Swiss Federal Statistics Office), Giampaolo Lanzieri (Eurostat), Lena Lundkvist (Statistics Sweden), Graça Magalhaes and Claudia Pina (Statistics Portugal), Marco Marsili (Istat, Italy), François Pelletier and John Wilmoth (United Nations Population Division), and Paolo Valente (UNECE).

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[1] Draft April 12th 2016. Preliminary version (please do not quote).

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# 1.0 PREFACE

The Conference of European Statisticians (CES) provides a platform for coordinating international statistical work among its member countries. Its main objectives are to improve national statistics and their international comparability, to achieve greater uniformity in concepts and definitions across national statistical offices, and to discuss and adopt statistical standards.

Each year the CES Bureau reviews selected statistical areas in depth to improve coordination among statistical agencies, to identify gaps and address emerging issues. These reviews conclude with concrete recommendations and may result in a Team of Specialists established to carry out specific tasks related to the recommendations. [http://www.unece.org/stats/ces/in-depth-reviews/poppro.html]

Following recommendations from the in-depth review, in October 2014 the CES Bureau decided to establish a task force to evaluate the aspect of communication in population projections. The objective of the Task Force is two-fold: to provide a series of good practices in regards to communication of population projections and to develop a database of existing population projections in UNECE countries.

**This preliminary report aims to present the recommendations proposed by the Task Force on population projections in regards to the first objective. These recommendations and good practices identified here are not final but rather "work in progress". Readers are therefore strongly encouraged to provide comments and suggestions that can contribute to their improvement. Feedback can be provided either in person at the Eurostat/UNECE workshop on population projections, or by email, by communicating with:**

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# 2.0 INTRODUCTION

It may seem limitative to dedicate a Task Force to the sole aspect of communication in population projections. Indeed, statistical agencies generally spend most of their time developing techniques and models for the preparation of assumptions and the calculation of parameters; communication is only one aspect of the workload. Ultimately however, the development of population projections must be oriented by their raison d'être, which is to communicate results to users that can help them planning for the future. So the first step is really to have a discussion about the goals of population projections and the means to achieve them. In that sense, communication encompasses not only the means by which projections must be disseminated to users but also what should be communicated and how.[1]

The special nature of population projections— having an uncertain, future orientation—leads to a plethora of possible approaches and interpretations; as will be seen in this report, practices among National Statistical Offices (NSOs) reveal more divergence than universality. This report reviews major challenges related to the communication of projections, providing some recommendations in terms of broad general principles as well as more specific good practices. While the examples provided and the various NSO's practices studied relate mainly to population projections by age and sex built with the cohort-component model (by far the most common), the recommendations are broad enough so that they to encompass all kinds of projections (such as projections of households, projections of the population given some characteristics) and methods (simple extrapolations, cohort-component model, cohort-progression methods, microsimulation, etc.). At the minimum, it is hoped that the report will trigger important discussions lending agencies to better situate and orient their practice with this knowledge in mind.

The report starts with a chapter on methodology explaining the general approach used by the Task Force for collecting and analysing data. Chapter 4 presents the different key recommendations and good practices proposed in the report and is divided in 4 different sections: 4.1 Dissemination of results, 4.2 Transparency in population projections, 4.3 Handling uncertainty in population projections and 4.4 Fostering relationships with users.

[1] It should be noted that the methodological aspects of population projections have been covered in a report provided by a panel of experts convened in 1998 by the National Research Council's Committee on Population (see NRC 2000). The panel was asked to examine the scientific foundation of the methodology and assumptions of recent population projections and to review their accuracy. While the exercise was focussed mainly on world population projections, the report provides several recommendations that apply in large part to national and sub-national population projections.

# 3.0 METHODOLOGY

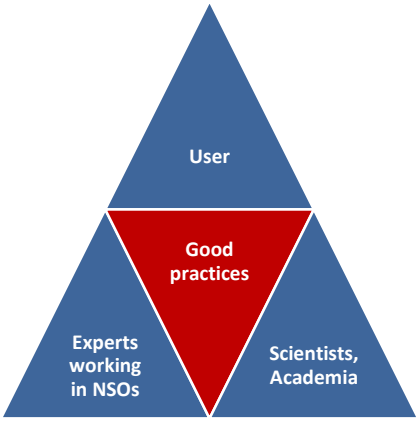
This section provides details about the general approach adopted and the data collection tools developed in order to identify and formulate the recommendations and good practices that are proposed in this report.

## 3.1 Methodological framework

While population projections results appear simple on the surface—future population figures broken down by some characteristics (mainly, geography, age and sex) — their speculative nature and the complexity of the process undertaken to build them require supplementing them with assessments of their uncertainty and thorough documentation. There are important challenges associated with these tasks, including often a poor understanding of user needs and/or perceptions and the general challenge of disseminating complex scientific notions. In fact, the general concepts of forecasts or projections, and what can be expected from such exercises are often themselves misunderstood.

These difficulties are not unique to demographers alone, but to scientists in general. In recent years, crafting adequate communication of complex science-related topics such as climate change or pharmaceutical research to non-expert audiences has proven especially difficult, with the acute danger of developing mistrust in science when unsuccessful. In fact, the difficulties in communicating science to the public have long been recognized and constitute a field of study in itself, most often referred to simply as *Science Communication*.[2]

**FIGURE 1**




The research framework guiding the production of this report has been inspired in part by concepts and methods developed in the field of Science Communication. In particular, an attempt was made to better understand the information that users need and to comprehend their pre-existing interpretations and their decision-making process. In fact, only when a contrast between what users need and what they already know is made can an effective communication plan really be designed (e.g.: Bruine de Bruin and Bostrom 2013). This framework calls

[2] As such, it has its own journals, such as Science Communication (since 1979) and Public Understanding of Science (since 1992); dedicated research and educational organizations, such as The Center for Communicating Science (founded in 2009); dedicated workshops such as the AAAS Communicating Science workshops (developed by the Center for Public Engagement with Science and Technology), the Arthur M. Sackler Colloquium "The Science of Science Communication" (held in 2012 at the National Academy of Sciences in Washington); and research centers associated with Universities.

for an integrated approach encompassing several points of view: those of the experts working to produce population projections (the National Statistical Organization or NSOs), those of projections users, as well as the viewpoints of scientists or academic experts. Clearly, contradictions between those viewpoints can lead to unsatisfying communication of projections results, and a variety of detrimental situations:

- Users could be unsatisfied with the disseminated product;
- Users could be satisfied but not understand the limitations of the data;
- Users could have access to more detailed information but are not aware about its availability;
- NSOs could have misperceptions about what users want, etc.
- Scientists or academic experts may be unaware of the practical limitations of NSOs.

To investigate these possible sources of conflict, this report compares and contrasts the three viewpoints. The good practices recommended in this report take into account these conflicting viewpoints, and are designed to satisfy as much as possible user needs, the resource limitations of producers and the requirements of scientists (Figure 1). Of the three perspectives, the user viewpoint is perhaps most vital to consider (thus why we place it at the top of the pyramid); as Fischhoff and Davis (2014) explain: "Science communication is driven by what audiences need to know, not by what scientists want to say".

## 3.2 Description of tools

Different tools were designed and implemented to collect data about these three viewpoints: a survey of the users of national population projections, a survey of NSOs who produce national population projections, a consultation with a number of experts working in academic or other (non-NSO) capacities in the areas of population projections and science communication, and a literature review.

### User survey

To better understand user needs, a survey was developed and sent to a sample of users of national and, in some cases, international population projections in June 2015. Data was collected during the summer of 2015. Survey responses are helpful to avoid inferring or incorrectly assuming user needs. While individual NSOs may have at times inquired as to the needs of their own users in various manners, the Task Force was not aware of large initiatives in this regard. Indeed, it became clear in the NSO survey responses that most NSOs have a very limited idea of who their users are.

Results of the user survey appear to be very useful, but caution is nonetheless necessary because of limitations in the sampling methods used. In short, because only a limited number of NSOs were involved in the identification of projection users (essentially those represented in the Task Force), and because the sample nearly exclusively consisted of users who had previously contacted these NSOs for information (as most NSOs had no other ways to identify users), it is not possible to

determine how representative the sample of users is. Responses indicate, for example, that the majority of user respondents considered themselves to have “high” or “intermediate” as opposed to “low” familiarity with population projections.

The user survey consisted of approximately 20 questions, covering topics including: the user’s associated organization, the reason for using population projections, the importance and evaluation of various elements of the disseminations, whether users had contacted the NSO in the past for information and their associated level of satisfaction with that interaction, and what aspects of the communication of projections produced by their NSO could be improved upon in their view. In total there were 151 respondents to the user survey. The questionnaire sent to users can be found in Appendix 1.

## NSO survey

An additional survey was developed and sent to NSOs from country members of the UNECE (covering Europe, North America and Central Asia). The survey, consisting of approximately 30 questions, asked the producers of national population projections some basic questions about their projections, the information that is disseminated in their publications, their approach to communicating uncertainty, their level of interaction with users and what they see as the main challenges in communicating projections to users. The survey was sent to respondents in the month of June 2015.

The responses to this survey provide a means to know more about NSOs practices, perceptions, capacities and limitations. It also tells us about what types of information NSOs feel are necessary to communicate to users. In total there were 32 respondents to the NSO survey. The questionnaire sent to NSOs can be found in Appendix 2.

## Expert consultation

A third tool consists of an external evaluation of the key recommendations and good practices by several experts working in the fields of population projections and science communication. A first step in this consultation is the presentation of this preliminary report at the Eurostat/UNECE workshop on population projections in April 2016. This conference will be an adequate forum for thorough discussions on the content of the report. However, other ways to consult experts could also be used in the future. It is still unclear at this time how the full consultation process will be carried out.

In receiving the feedback and views of these experts, the aim is to obtain an evaluation of the recommendations in light of scientific knowledge, and to incorporate more formally the point of view of scientific experts, as a complement to the analysis by the Task Force of existing literature relevant to the topic. Some topics covered in this report, the most notable being the communication of uncertainty in science, are, at the time of writing this report, the subject of substantial research and debate, and it is believed that formal inputs by experts could be strongly beneficial in developing sound and informed recommendations. A scientific viewpoint is also sought in regards to what science communication can tell about efficient ways to communicate science-related topics to the public. However, because the recommendations are intended to

reconcile as much as possible three points of views (users, NSOs and experts), it must be clear that the Task Force is not be bound to the views of experts alone.

## Literature review

Finally, literature review supplemented the analysis and the contrast of the user, NSOs and experts perspectives. It covered scientific articles in several fields such as psychology, communication and demography and an examination of publications released by NSOs. Literature review also provide key insights about effective ways to communicate complex scientific results.

# 4.0 KEY RECOMMENDATIONS AND GOOD PRACTICES

This chapter contains the various suggestions identified by the Task Force in regards to communication of population projections. For clarity, these suggestions are separated in 4 different sections, describing different aspects of population projections: 4.1 dissemination of results, 4.2 transparency in population projections, 4.3 uncertainty in population projections and 4.4 fostering relationships with users. Within each section, these suggestions are further separated into *key recommendations*, which are some high-level objectives that should be pursued, and *good practices*, which represent more specific and tangible ways to accomplish these objectives.

## 4.1 Dissemination of results

### Introduction

Successfully communicating projection results is perhaps the most important responsibility of population projection makers; if users face obstacles in accessing or correctly interpret the information they need, the desired messages that projection makers wish to provide them may not be received. One of the recommendations suggested by the National Research Council's panel of experts convened to examine the methodology and assumptions of population projections is to investigate how projections are used in order to propose improvements in presentation (NRC 2000). The data form the *user survey* created for the current report provides an opportunity to make a step in this direction. Other tools drawn upon in developing recommendations on communicating projection results include: consulting experts, reviewing the relevant literature and the analyzing the responses of the *NSO surveys*. Special attention was given to identifying in particular any gaps in what was generally being disseminated by NSOs versus what was needed by users and any misconceptions on the part of NSOs in terms of user needs.

More specifically, the NSO and user surveys gathered information on aspects of dissemination such as:

- Projection horizon produced by NSOs versus the horizon that is usually needed by users;
- Frequency of projection updates by NSOs versus whether users considers the updates frequent enough;
- The most common requests for technical assistance received by NSOs;
- User's level of satisfaction with any previous requests for information to NSOs;
- Whether users consider the language of the disseminations too simplistic, adequate, or too technical;
- Initiatives/strategies for communicating population projections to users that have been most successful for NSOs;

- Aspects of disseminations that NSOs think their users would like to see expanded or improved versus user views about what aspects of the communication of the projections could be improved;
- What projection elements are disseminated by NSOs versus the importance given to those elements and associated satisfaction on the part of the users;
- Whether users consider the projection data to be easily accessible and adequately detailed.

While there were some mismatches in terms of NSO perspectives about users compared to the perspectives of users themselves, there was also a considerable amount of overlap, suggesting that NSOs do understand broadly the areas in which users feel they could improve the communication of projection results. Specifically, both NSO and user respondents mentioned a need for:

- Customizable/interactive databases
- Expanded analysis of the uncertainty or reliability of projections
- Customized disseminations for different types of users

Users seemed to be generally satisfied with the disseminations of their NSO, but there was a general expression of the need for detailed results. Thus the following key recommendation and associated good practices focus on providing comprehensive information about the projection results.

# Key recommendations and good practices

**Key recommendation 1.1: Provide detailed results and information about the projections.**

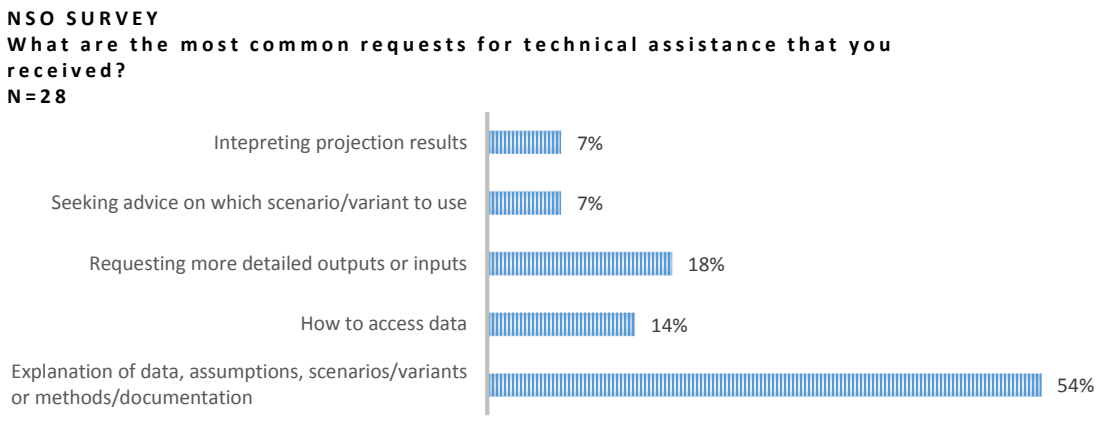
The responses to the *user survey* show that NSOs are generally meeting the needs of users and disseminate projection results that are most important to them and in a sufficient level of details. Nonetheless, as the Internet era has become firmly entrenched in society, user expectations for highly detailed, flexible and easily accessible information have grown stronger and demands in this regard are likely to only continue to grow in the future. NSOs should therefore regularly evaluate their dissemination procedures with a view to improving the interpretability, accessibility and relevance of their projection results.

Results from the *user survey* also show that a certain proportion of respondents found the language of their NSO's disseminations "too technical", and several felt that communications could be improved if different types of communications were developed for different types of users.

Further emphasizing the importance users give to detailed dissemination information, some of the most frequently mentioned areas for improvement in NSO communications, as seen in the results of the *user survey*, included greater availability of detailed projection data and greater elaboration

of methodology and assumptions. In contrast, respondents to the *NSO survey* did not appear to view more detailed projection data as an area of user concern in their opinion. This suggests that NSOs may underestimate or be unaware of the desire on the part of many users for detailed information in all aspects of the projections. Indeed, more than half of NSOs noted that they most commonly received requests from users for further explanation of projection data, assumptions, and methods (Figure 2). The challenge is that given limited resources, NSOs might need to choose which of several dissemination elements to expand upon, if any.

**FIGURE 2**




## Good practice 1.1.1: Communicate results through a variety of means of communication

Projection users are a diverse group, differing in their level of familiarity with statistical concepts and techniques, the field of demography, as well as their motivations for consulting projection disseminations. Users were asked whether they considered the language used in the projection dissemination to be “too simplistic”, “appropriate”, or “too technical”. It is noteworthy that while the large majority of user respondents felt the language was “appropriate” (83%), there were more instances of users finding the language “too technical” (7%) than “too simplistic” (1%). This suggests that making efforts to improve communication of results to non-expert users could be particularly beneficial.

Recommended strategies for reaching the widest possible audience are:

- Use plain, simple language in order to ease interpretation for different types of projection users. Choose words with a single definition or connotation and be consistent with word use.
- To further clarify important terminology (particularly that that is more technical in nature), include a glossary with clear definitions.
- Include in the dissemination an introductory text box or chapter for users which sets proper expectations for the use of the projections and explains in a high-level manner their key caveats and limitations. An excellent example can be found from the Population Reference Bureau report “Understanding and Using Population Projections” (Population Reference Bureau 2001).

- If possible, pre-test draft dissemination materials on a small group of non-expert users to ensure that terms are well defined and interpreted as intended.[3]
- Repeat important messages in various forms (verbal, numeric and graphical). As noted by Kloprogge et al. (2007), users differ in their preferences in terms of specific form of presentation; repeating messages using different forms may result in a better understanding and increase the chance that the user will notice and correctly interpret the information.

### Good practice 1.1.2: Introduce information in a progressive manner.

An efficient strategy for communicating information of different technical levels to a variety of users is to release it in different layers of increasing complexity. This approach, often referred to as *Progressive Disclosure of Information*[4], helps create an efficient instructional design by minimizing the load on the working memory and segmenting complex explanations in intelligible portions (Kalyuga 2011). The *Progressive Disclosure of Information* also allows uncertainty to be communicated in a gradual and repeated manner by integrating it as part of the message in the various layers of the communication (Kloprogge et al. 2007, Wardekker at al. 2008).

Many NSOs tend to follow more or less consciously the approach of *Progressive Disclosure of Information* by releasing their projection results in several distinct layers, aiming for a large coverage by a variety of audiences. For instance, a NSO might publish, in parallel to a detailed report, press releases, shorter communications intended for media, or shorter articles summarizing the results. These shorter communications are often those that have the highest exposure in the public and are often the only medium by which the larger public will be informed about a given topic.

Another frequently-used strategy is to provide a separate technical report to present the methods and assumptions. However, several studies show that the readers tend to spend limited time reading such detailed reports (Kloprogge et al. 2007). It is therefore essential that a general statement about uncertainty permeates the primary layers of the communication of population projection results, and not be found only in a detailed technical report.

### Good practice 1.1.3: Disseminate projection results by single age and year whenever possible.

The large majority of respondents to the *user survey* (84%) felt that obtaining projection results by single year and age was important. It appears that the majority of NSOs are already providing data outputs in this desired format: 87% of respondents to the NSO survey reported that they

[3] As recommended in Centers for Disease Control and Prevention (1999).

[4] The concept of *Progressive Disclosure of Information* takes its origins from computer application engineering where it is used for improving interactions between humans and computers. It is also used in journalism.

disseminated their projections by single years of age and 81% by single projection years. Providing projections by single year offers users more flexibility, particularly in regard to the short-term.

Good practice 1.1.4: Provide results for both short-term and long-term horizons, making clear that uncertainty of projection results increase with the length of the projection horizon.

The needs of users in regards to projection horizons are varied. As seen in Table 1, while respondents to the *user survey* most frequently expressed a need for a projection horizon of 10 years (considerably lower than the modal horizon of 50 years disseminated by respondents to the NSO survey), horizon needs ranged from as short as 1 year to as long as 150 years in the future among user respondents.

**TABLE 1**

| | **Projection horizon in years** | | | |
|---|---|---|---|---|
| | **Mean** | **Mode** | **Min** | **Max** |
| NSO (disseminated) (N=32) | 54 | 50 | 25 | 100 |
| User (needed) (N=140) | 31 | 10 | 1 | 150 |

Given the diversity of horizon needs on the part of users, NSOs should make efforts to disseminate information about short, mid and long-term projection assumptions and results. For instance, if it is thought that immigration will decrease in the long-term, variations in the short-term should also be taken into account and discussed in disseminations, as this will respond to needs of users interested in short-term projections and should also provide more plausible results in the long-term (as "errors" in the projection will increase over time).

The tendency for user respondents to favour a considerably shorter projection horizon than what NSOs produce raises the question of whether NSOs should consider shortening the length of their projection horizons (from an average of 50 years to an average of 30 years, for example). Indeed, it is well documented that accuracy tends to increase with time elapsed since the projection[5]. The report provided by the panel of experts convened by the National Research Council's Committee on Population to review different aspects of population projections concludes suggests that beyond a period of 50 years, forecasts involve so much uncertainty that they should not be produced (NRC 2000). Particularly in the case of population projections, fertility assumptions become increasingly perilous beyond 25 to 30 years, after which to uncertainty in the birth rates is added the uncertainty on the numbers of potential mothers in the population (Lutz et al. 1994, Leridon 2015).[6]

Nonetheless, some users do require longer-term projection horizons for planning. One area where such projections are required is for the study of the long-term viability of pension plans (typically horizons of 75 years are used). Recognizing the disparity between a reluctance of projection

[5] See for example George et al. (2004) and. Keilman (2007).
[6] There are of course other sources of increasing uncertainty over time in projections; Lutz et al. (Ibid.) provide a summary of the impacts of possible other sources of uncertainty in regards to projection horizon.

makers to go beyond a certain time horizon and expectations of some users, Lutz et al. (1994) recommend making clear distinctions between projections made for short- or mid- term horizons and those made for longer horizons (typically for more than 30 years). However, the provision of a long-term projection should not be a problem as long as it is accompanied by an appropriate relevant estimate of its uncertainty. As Lee (1998) points out, the increasingly wide prediction interval over time will inform users of the growing uncertainty and allow them make their own decisions about the relevance of using projection results for long horizons (see good practice 1.1.5, and more generally section 4.3 about communicating uncertainty in population projections).

### Good practice 1.1.5: Make uncertainty a result in itself

The exercise of making population projections informs us about what outcomes could be plausible in the future but also about plausible levels of volatility associated with these outcomes. Therefore, an important recommendation in this report is to acknowledge the uncertainty associated with population projections and to consider this uncertainty as a pertinent and, in fact, essential result to be disseminated. The question of how this uncertainty should be handled in projections is a key issue and is treated in more detail in section 4.3

### Good practice 1.1.6: Offer customizable/interactive projection data to users in tabular or graphical formats

As noted by Morgan and Henrion (1990), if users can be actively involved in the selection and design of graphics to suit their special interests and skills, their experience is likely to be more motivating and educational than traditional, passive modes of communication. A frequent comment by respondents to the *user survey* was the desire for more flexible/ interactive/ customizable data, in which the user could select the desired combination of assumptions from a given list and potentially generate their own custom scenarios. Users also gave high importance to flexible output data with the ability to customize table parameters.

There are perhaps many obstacles to producing a customizable projection tool such as this. For many NSOs, it may simply be impossible given the format of their website, or too resource-intensive, to create an electronic application such as this. It could also lessen the user focus on the published analyses of results, which would presumably be focused on a small number of scenarios which the projection maker deems most representative of the range of plausible options. NSOs may have limited space and resources available to analyze in detail all possible combinations of assumptions developed.

In principle however, offering a tool such as this to users could improve user understanding of the sensitivity of projections to assumptions and/or the degree of population inertia. It could also generate new or deeper interest in projections, as users would be able to see and understand more directly how a projection is produced, and explore more fully the range of possible assumption combinations offered by their NSO.

A good example of the provision of such customizable projection data can be found from Statistics Norway[7], who offers to users the option of customizing projection output data in both tabular and graphical forms.

### Good practice 1.1.8: Disseminate figures on population rounded to hundreds or tens

Projections are estimates about population in the future, regardless of the methodology used in its production, have some uncertainty. Disseminating the results in units, can give an impression of precision that they do not have. Rounding the results in hundreds (or tens if the population is relatively small) reinforces the fact that projections results are uncertain while not really diminishing their utility.

[7] https://www.ssb.no/statistikkbanken/selectout/pivot.asp?checked=true Accessed November 20, 2015.

## 4.2 Transparency in population projections

### Introduction

Transparency is a basic principle of good scientific practice. Transparency requires that in addition to explaining which method is used, the forecaster should specify which underlying choices and assumptions are made, what the arguments for these choices and assumptions are and what the consequences of these choices and arguments are (de Beer 2011). Morgan and Henrion (1990) note that scientific research reports should provide descriptions of procedures and assumptions to a level of detail sufficient for others to undertake a replication of the results. Although this can be difficult to do in practice, the documentation should be prepared with the ideal of reproducibility in mind.

Responses to the surveys of NSOs and users suggest that users have a strong desire for detailed information about all aspects of the projection-building process. A sizeable percentage of respondents to the user survey users felt that there was not detailed enough information about the current demographic context/trends (21%), the projection assumptions (29%), the methodology (24%) or the information about the underlying sources (22%). This could relate in part to the fact that 22% of users felt that the projection data are not easily accessible, an issue discussed further in the *Disseminating Results* and *Fostering Relationships with Users* chapters.

Users appear to highly value this "background" information, perhaps even more so than the projection results themselves: A large majority of respondents to the user survey clearly indicated that receiving information about such elements was important or very important to them—including information about the current demographic context (90% of users agreed), assumptions (86%), methodology (78%) and quality of underlying data sources (76%)—higher even than the proportion that considered detailed analysis of results to be important (70%).

For their part, NSOs seem to also consider information about how the projections were produced to be a key element of their disseminations: Respondents to the NSO survey dedicated on average over one-quarter of their total disseminations to describing projection assumptions, the highest share of any projection element. Yet, among the various dissemination elements, it was for projection assumptions that the highest proportion of respondents to the user survey expressed dissatisfaction in the level of detail disseminated by their NSO. Thus, while NSOs appear to be dedicating a substantial portion of their disseminations to the discussion of projection assumptions, improvements could potentially be made in the focus and content of those descriptions to better suit user needs for both qualitative, contextual information and detailed quantitative data. It is therefore recommended that NSOs consider implementing the following key recommendations and good practices.

# Key recommendations and good practices

**Key recommendation 2.1: Document and disseminate the main activities that led to the decision to develop new projections methods or assumptions.**

Formulating the decision to develop new projections is the first step in their creation. Users should be informed about the major factors and decisions which led to the creation of the new projections, as well as any key changes in approach from previous editions.

### Good practice 2.1.1: Describe how the new projections differ from previous editions

It is recommended that NSOs make apparent to users if and why projection assumptions differ from previous editions. Indeed, when asked to indicate aspects of the communication of the projection that could be improved, several respondents to the user survey mentioned that they would like to see an enhanced analysis or explanation of changes in outlook from previous editions of projections. For users who are familiar with a previous edition of projections, a comparison of the new methods and assumptions versus the old ones can facilitate the learning process.

One of the first tasks carried out for the elaboration of new population projections, is the evaluation of the performance of the previous one. Because of the urgency for the elaboration of the new projections or the lack of time or resources, this task is not always carried out or is done very quickly. In any case, it is very important that users are aware of the results of this evaluation.

Regardless of the depth of this evaluation, this allows to conclude various aspects to be considered in the new projection, such as possible changes in the methodology and procedures to be followed for the definition of assumptions and calculation of projections.

It is also important that users are aware of conditions under which updating is made. If there is an updating schedule, it is recommended to be public knowledge. If there is no such schedule or if an update is performed out of schedule, it is recommended to clearly inform the reasons that you have for this update.

### Good practice 2.1.2: Describe the key factors that led to the decision to produce new projections

NSOs may formulate new projections on a set schedule (for example, following each new census) or when motivated by substantial demographic shifts or policy changes. In either situation, the elaboration of new projections should always be accompanied by a description of the factors taken into consideration which led to the decision to produce them.

Good practice 2.1.3: Update the projections on a regular and predetermined basis or when important demographic changes affect the pertinence of the assumptions.

The updating or revision of projections of population is a common practice. It follows most often the updating of the base population (e.g., when new census data becomes available). However, the criteria that lead to an update or revision is not always well defined and may, significantly influence the results. Then, it is important establish clearly the reasons for the update's projections, especially when these updates are not made with an established periodicity. If it is set when revisions to the projections are made, it is recommended that users are informed of the periodicity. If a review is needed outside the pre-established periodicity, it is recommended to inform users in a timely manner.

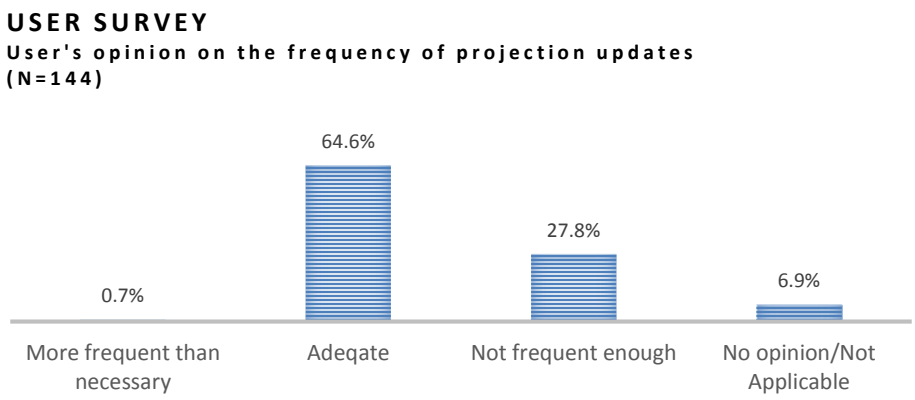
Among NSOs, projections were most frequently updated on a 5-year basis, ranging from a minimum of 1 year to maximum of 10-year updates (Table 2).

**TABLE 2**
**Update frequency of projections among NSO respondents (N=31), in years:**

| Mean | Mode | Min | Max |
|---|---|---|---|
| 3.8 | 5 | 1 | 10 |

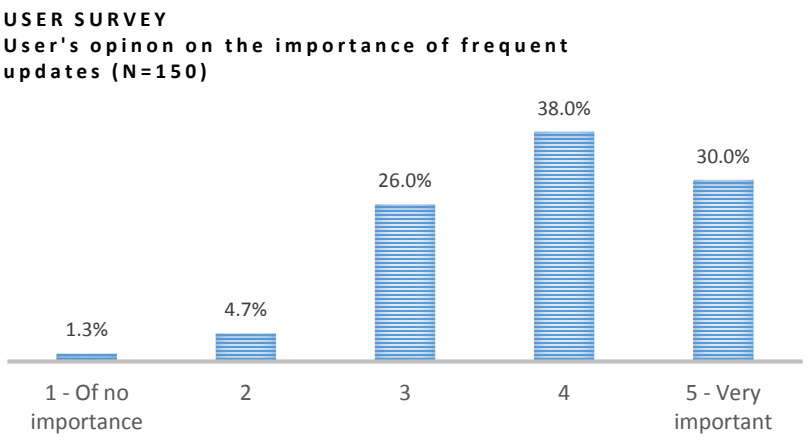
Among users who responded (N=145), the majority (65%) felt that the frequency of projection updates by their NSO was adequate, while 28% felt it was not frequent enough (Figure 3).

**FIGURE 3**




Moreover, the majority (68%) of users (N=150) affirmed that frequent updates of projection were important or very important (on a scale from 1 to 5, where 1 is “of no importance” and 5 is “very important”) (Figure 4).

**FIGURE 4**




## Key recommendation 2.2: Provide a clear and complete description of the projection methodology.

One of the conclusion of the report prepared by the Panel on Population Projections of the National Research Council's Committee on Population is that "users would benefit from clearer presentation of the underlying methodology and assumptions". (NRC 2000, p.12). Providing detailed and clear information about how the projection results were produced allows users to better interpret the results, as well as to better understand their limitations and the context under which they were built. As de Beer (2011; p.215) suggests, "[t]he forecaster should make the methods and assumptions transparent in order to make it possible for the user to determine how to interpret the outcomes of the calculations." Also, a clear description of the assumptions and methods allows users to make their own decision regarding whether a projection is adapted to their needs (Armstrong 2001).

### Good practice 2.2.1: Disseminate the projection inputs in sufficient detail so as to facilitate reproduction

To promote reproducibility, it is a good practice, whenever possible, to disseminate projection inputs (for example, age-specific fertility rates) in the same level of detail as was utilized in the building of the projection.

Data from the NSO survey show that in general, NSOs comply with requests for input data from their users, as shown in Table 3.

**Table 3**

| **Q19.** Upon request, would you distribute detailed parameter/input data to allow users to reproduce the projections, or similar projections? | |
|---|---|
| Yes | 25 |
| No | 5 |
| Don't know | 2 |

Projection makers should also be willing and able to engage in direct communication with users (upon request) regarding their methods and to provide input data to users to help them reproduce the results.

### Good practice 2.2.2: Describe the consultation process and its outcomes

Most NSOs appear to engage in some form of consultation in the process of creating their projections. Data from the NSO survey show that two-thirds of NSOs had noted some or all of their consultations in their disseminated products (Table 2).

**Table 4**

| Q21. If you consulted any bodies during production of the projections, were these consultations noted in disseminated products? | |
|---|---|
| | Cases |
| All of the consultations were noted | 11 |
| Some of the consultations were noted | 8 |
| No, the consultations were not noted | 10 |
| Not applicable (there were no consultations) | 2 |
| NR | 1 |

Documentation of consultations may help contextualize why some decisions were taken in the production of the projections. Such descriptions can also reveal the areas where there can be lack of consensus or greater uncertainty. Good examples of thorough documentation of the expert consultation process can be found in Box 2.

**Box 1: Good examples of documentation of consultations with experts**

**Central Statistics Office (Ireland)**
In the assumption-building process for their 2011-based Population and Labour Force Projections, the Central Statistics Office of Ireland received input and advice from a large Expert Group. The associated report presents the projection assumptions including descriptions of the elements that the Expert Group considered most important, hence helping users to follow the thought process that lead to the adoption of the final assumptions. The report ("Population and Labour Force Projections 2016-2046") can be found on the Central Statistics Office's website: http://www.cso.ie/en/media/csoie/releasespublications/documents/population/2013/poplabfor2016_2046.pdf

**Office for National Statistics (UK)**
For their 2014-based National Population Projections, the Office for National Statistics (UK) published the complete minutes of their Expert Advisory panel meetings. This exhaustive rendering of the dialogue between experts and members from the ONS makes it possible to identify the topics that triggered greater discussion or for which there is less consensus. These minutes ("National Population Projections: 2014-based projections", Chapter 1, Annex A) can be found on the ONS website: http://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/compendium/nationalpopulationprojections/2015-10-29/backgroundandmethodology#appendix-a-minutes-of-expert-panel

**Statistics Canada**
For their 2013-based National Population Projections, Statistics Canada surveyed the community of Canadian demographers in order to gather their opinions about future demographic trends. In the technical report on the methodology and assumptions that was released along with the report of the results, they describe the results of the survey, often using box-plots graphs that show mean responses as well as their spread. It is therefore easy to identify areas where consensus is lacking. The technical report ("Population Projections for Canada (2013 to 2063), Provinces and Territories (2013 to 2038): Technical Report on Methodology and Assumptions", Chapter 2) can be found on Statistics Canada's website: http://www.statcan.gc.ca/pub/91-620-x/2014001/chap02-eng.htm

### Good practice 2.2.3: Acknowledge any relevant stakeholders

If applicable, NSOs should provide a description in dissemination materials of major stakeholders, particularly those who may have had any influential role in the production of the projections, whether because they provided some degree of funding or for other reasons. When possible, the impact of stakeholders on the production of the projections (for example, changes in assumptions) should be specified.

### Good practice 2.2.4: Document the technical and methodological changes of new projections as compared to previous editions

Where applicable, users should be informed of any changes in the methodology used to produce the projections in comparison with previous (particularly the immediately-preceding) editions. The projection period for each edition should also be clearly identified in high-level dissemination materials such as publication titles so that editions can be easily distinguished.

### Good practice 2.2.5: Describe the quality of the data source

The quality of the projection inputs has a direct impact on results. Therefore, an assessment of data sources used should be provided to users. NSOs should clearly identify the data sources used to build the projections, commenting on their major quality features and any associated impacts on the assumption-building process. Information on the procedures of evaluation and eventual adjustment of the data used at the onset of the projection should also be provided.

A population projection takes as its starting point the most recent estimate of the population, usually by age and sex. Accordingly, it is recommended that the presentation of the projection results include at minimum a brief description of the procedure followed to obtain the base population. In several countries, this population is essentially derived from the last population census or from the population register. However, adjustments (for coverage and other factors) are almost always made and should be noted in disseminations.

### Good practice 2.2.6 Provide justification for the choices of assumptions, horizon and methods

It is not sufficient to simply list the projection assumptions and describe the method of projection. As de Beer (2011) explains, the arguments underlying the choices of assumptions and methods and their consequences should also be provided. He gives the example of data extrapolation methods: the impact of the choice of a reference period should be described, especially when it is sensitive or particularly consequential. In general, all key decisions made in the process of building the projections should be detailed. Logical links should be made between descriptions of the current demographic context, projection assumptions and the choice of the methods, including their strengths and limitations.

### Good practice 2.2.7: Provide descriptions of the methodology used to project the population.

The general projection model should be described, along with its strengths and limitations. It may often not be necessary to dedicate a large part of the dissemination material for this purpose if some pre-existing documentation can be referenced. In the case of the cohort-component method

of projection, by far the most-widely used by national agencies, there are some papers to which users can be directed for more information[8].

### Good practice 2.2.8: Provide a description of the software programs used to produce the projections

While it is possible that for various reasons the software used for the preparation of projections cannot be available to users, it is recommended to at least present a general description of the calculation procedures used by the software.

While it is possible that for various reasons the relevant software may not be available to users (if it is developed and operated in-house, for example), a general description of the software and its calculation procedures should be provided to users.

## Key recommendation 2.3: Clearly define key terms used in dissemination products

To be properly understood, communications must use clear and well-defined terms. Accordingly, key concepts should be defined as they are introduced in the dissemination material. One recommended way to achieve this practice is to include a glossary of key terms in dissemination materials. In particular, key terms associated with projections such as projection, forecast, scenario or variant, should be defined and it should not be presumed that users share the same understanding of these terms as the projection maker. This report contains a glossary (*yet to be made*) providing suggestions for choices of terms

## Key recommendation 2.4 Assess the performance of previous projections

Many NSOs have adopted the practice of analyzing the performance of their past projections, sometimes supplementing the publication of new projections with an in-depth analysis of the performance of past projections (see Box 1 for some good examples). Repeated comparison of projected values with historical estimates reveal the limitations of population projections and inform users about what can reasonably be expected from them. Engaging in this exercise is also a means for NSOs to reflect on the sources of past inaccuracies, serving as a basis for improving future projection assumptions and methodologies (Wilson and Rees 2005). Measurements of past errors have also been used to produce prediction intervals around new forecasts in the production of probabilistic projections (e.g. Keyfitz 1981, Stoto 1983).

Such exercises should nevertheless be accompanied with some caution. The fact that population projections are not perfectly accurate does not render them totally useless. Indeed, as Romaniuc (1994) observes, the future is not only something to be discovered, but can also be seen as something to be created. He adds that projections can be instrumental as planning tools when peers and users recognize their analytical credibility. Besides, an inevitable limitation of such

[8] M. V. George, Stanley k. Smith, David a. Swanson, and Jeff Tayman. Population Projections in "The Methods and Materials of Demography". Second Edition. Elsevier Academic Press. Siegel, J. S. and Swanson, D. A. Editors. USA. 2004

analysis is the fact that projections are used as means to influence the future, and thus can trigger outcomes that will prove them wrong; the problem of self-defeating prophecy. Another caution is that a projection is never perfectly comparable to the previous ones as there can be changes in the methods and in the demographic context. These caveats should be kept in mind and communicated to users in any relevant dissemination materials.

While an in-depth analysis of previous projection performance is ideal, NSOs may not necessarily need to undertake such exercises with each new edition produced. At minimum however, it is recommended that disseminations make some reference to the performance of previous editions, linking the discussion logically to a larger acknowledgement of the uncertainty of projections.

**BOX 2: Examples of good practice in communication of the past performance of projections**

National Research Council (2000) Beyond six billion: Forecasting the world's population. Panel on Population Projections. BongaartsJ and Bulatao R (eds.). Committee on Population, Commission on Behavioral and Social Sciences and Education. Washington DC: National Academy Press.
Internet: http://books.nap.edu/books/0309069904/html/index.html.

Office for National Statistics (July 2015). *National Population Projections Accuracy Report.*

Population Reference Bureau (2001). *Understanding and Using Population Projections*. Measure Communication Policy Brief.

Shaw, C. (2007). Fifty years of United Kingdom national population projections: how accurate have they been? *Population Trends (*128): 8-23.

Statistics New Zealand (2008). *How Accurate are Population Projections? An evaluation of Statistics New Zealand population projections, 1991-2006*. Wellington: Statistics New Zealand.

Statistics Sweden. 2012. The future population of Sweden 2012–2060, Demographic Reports, Statistics Sweden, Forecast Institute.
Internet: http://www.scb.se/statistik/_publikationer/BE0401_2012I60_BR_BE51BR1202ENG.pdf

Dion, P. and Galbraith, N. (2015). Back to the future: A review of forty years of population projections at Statistics Canada. *Canadian Studies in Population*, 42:102-116.

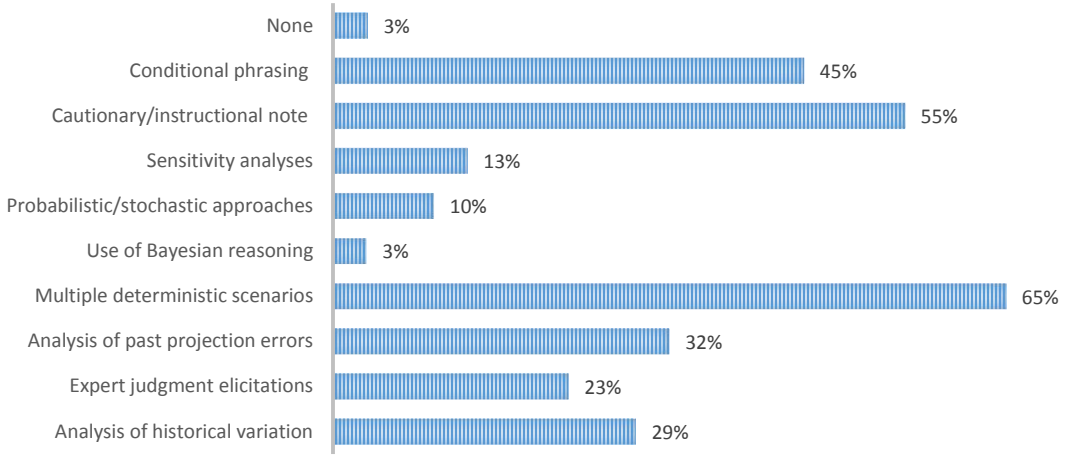
## 4.3 Uncertainty in population projections

### Introduction

The examination of current practices in population projections undertaken for this report revealed that the commitment of statistical agencies to communicate uncertainty in regards to their population projections, and the approaches used in doing so are uneven, to say the least. As an example, Figure 5 shows the proportion of NSOs who utilized various methods to communicate uncertainty in their disseminations. While the majority utilized multiple deterministic scenarios and cautionary/instructional notes, less than half used conditional phrasing, a simple and effective means of indicating the uncertain nature of results.

**FIGURE 5**

**NSO SURVEY**
**In your disseminations, did you use any of the following methods to communicate the uncertainty of projections to users? Indicate all that apply. N=31**



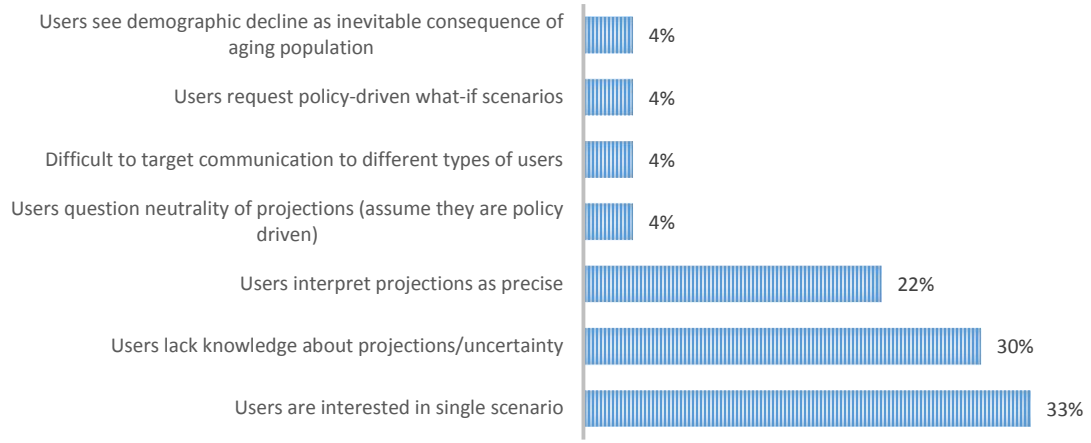

Survey findings also revealed variations in the number of scenarios produced and their characterization. For example, some NSOs disseminate a “most likely” scenario or only a single scenario while others provide multiple scenarios without any assessment in terms of likelihood attached. Even the use and definition of basic terminology, such as the difference between a “forecast” and a “projection”, was found to vary considerably across NSOs. This disparity of practices has increased with the publications in recent years of probabilistic projections in which specific prediction intervals are provided.

Reluctance to express uncertainty is not confined to projection makers only but touches scientific communications in general. Fischhoff (2012) identifies a few causes for this reluctance of experts: uncertainty is seen as giving misplaced or exaggerated imprecision; uncertainties may not be understood as intended; experts can be disparaged for communicating uncertainty; and perhaps most fundamentally, experts in many cases do not know how to express or measure accurately uncertainty. Results from the NSO survey provides confirm some of those challenges: approximately one-third of NSO respondents indicated that they felt users were interested in a

single scenario or lacked knowledge about projections/uncertainty, making it challenging to communicate uncertainty to them (Figure 6).

**FIGURE 6**

**NSO SURVEY**
**In your opinion, what challenges do you encounter in communicating the uncertainty of population projections to users (for instance, do projection users have any common misconceptions about the projections)? N=27**




The variations observed across NSOs in terms of approach to communicating population projections suggest that there is a need for some guiding recommendations and good practices in this regard. This outcome is echoed by several studies highlighting deficiencies in how uncertainty is handled in projections and a general sentiment among several demographers that this area remains underdeveloped in the field.[9] O'Neill et al. (2000) note that accurately characterizing the uncertainty associated with a projection is critical to ensuring that it is used appropriately, yet there is currently no generally-accepted approach for characterizing that uncertainty. The speculative nature of population projections makes it difficult to assess uncertainty (particularly in quantifiable terms). Indeed, the future is not an experiment from which we can collect data. Keyfitz (1981) recognizes that while statisticians have developed models for dealing with errors associated with estimates, these techniques don't apply to population forecasts. But he also writes: "The user of a population forecast has no less need to know its error than the user of a yield estimate or of an estimate of unemployment." Smith (1997) and O'Neill et al. (Ibid.) note that efforts made to consider how to best express uncertainty and convey this information to users should be a research priority and should be considered key to improving the quality and usefulness of population projections.

[9] Adequate measurement of uncertainty in population projections has been identified as an area severely requiring improvement in several studies in recent decades, including: Keilman et al. 2002; Keilman 2008; NRC 2000, de Beer 2000; Lee 1998; Keyfitz 1981; Stoto 1983. This is also a conclusion of the report prepared by the Panel on Population Projections of the National Research Council's Committee on Population, which stated "Official projections have neglected the important issue of the uncertainty surrounding forecasts." (NRC 2000, p.12).

Campbell (2011) provides a good description of the quandary faced by scientists in regard to uncertainty: "The values of openness and transparency in communication to stakeholders and publics, not to mention a modicum of due humility, necessitate an explicit acknowledgement of scientific uncertainties. But this obligation flies in the face of a strong concern that expressed uncertainties can themselves undermine public trust. Resolution of this contradiction depends on the context and on how you tell it". This chapter suggests some key recommendations and good practices on how to communicate uncertainty in population projections. It begins with a short discussion on the nature of uncertainty in population projections and the reasons why it must be communicated to the public.

## The nature of uncertainty in population projections

Noting the disastrous records of forecasters in some domains such as in Finance, Taleb (2012) warns against "the (unscientific) overestimation of the reach of scientific knowledge". He observes that because of structural limitations and an inevitable blindness with respect to randomness there are areas where the possibility of rare but very consequential events simply can't be assessed (2010).[10] Are population projections an area where predictions are almost inevitably doomed?

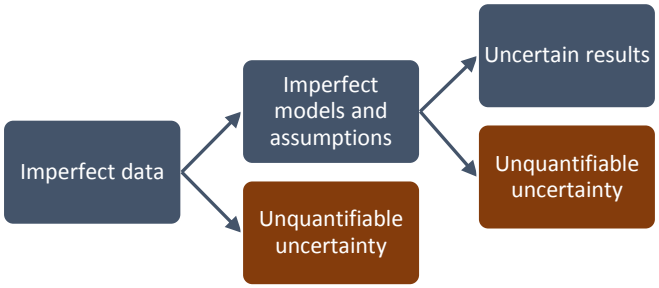
True, population projections usually perform well in the short-term thanks to demographic momentum and in the context of low variation of vital rates. For example, projections of population ageing in most industrialized countries can be considered as robust in the short and mid-term given their current age structures. However, the accuracy of population projections can be highly affected by unpredictable events such as war, economic crises or natural catastrophes. Indeed, the root of the current phenomenon of population ageing in much of the developed world is itself a purely demographic event that went largely unforeseen: the emergence of a temporary surge in the number of births, the baby boom, and its end after two decades, the baby bust (Keyfitz 1981, Reher 2015). These events have had long-lasting consequences in the countries that experienced them. For instance, the replacement over time of heavily populated cohorts of the baby boom by cohorts of relatively smaller sizes has caused stress on the sustainability of pension plans, causing proportional decreases in the labour force population and higher public expenditures for the care of elderly. One could argue that such an event would likely not be missed today because the techniques of projections have greatly improved over time, but there are no signs that this is the case or that substantial improvements will occur in the future (Keilman 2008). It would be foolhardy to think that demographers could not be surprised by another demographic event in the future.

Figure 7 shows how uncertainty permeates all facets of a projection. The data used to study the various phenomena which form the basis of the projection assumptions and the base population

[10] Taleb (2010) calls these events *Black Swans* (he capitalizes it), based on the logical metaphor of the black swan about the possibility of exceptions and the problem of induction. For him, almost everything in our world can be explained by such rare and very impactful events.

suffer from various degrees of error and variance. The models and the thought processes used to elaborate the assumptions and compute the parameters are not flawless either, as they are always a reduction or a simplification of reality. Some of the uncertainty can be captured by the modelling process and communicated to users; indeed, demographers have developed various methods to do so in recent decades in order to develop probabilistic projections. What is uncovered and what remains latent or concealed depends in large part on the choice of projection methods (Lee 1998).[11] However, the degree of uncertainty inherent to projections as a result of imperfections in the data and methods is difficult to identify and assess. There is, consequently, a large part of uncertainty that remains unquantifiable.

**FIGURE 7**




Only after the fact can we have a glimpse of this uncertainty as measured as ex post errors (Keyfitz and Caswell 2005). Demographers are mostly aware of this, as illustrated by the current common practice among NSOs of publishing a warning or cautionary note that the projections are the results of plausible assumptions that discount unpredictable events or circumstances such as economic crises, wars or natural catastrophes.

Knight (1921) proposed a distinction between risk, where the odds are computable, and uncertainty, where the odds are simply unknown. Accordingly, uncertainty is often characterized as *aleatory* when it comes from randomness, and as *epistemic* when its source is our lack of knowledge. In the case of population projections, the question of whether uncertainty comes from the fact that the future is not completely specified by the past (inherent randomness) or because of epistemic limitations is a metaphysical one as the result is the same: our knowledge of future population growth is uncertain (de Beer 2001). In the end, as Morgan and Henrion (1990, p.63) put it, “you see a quantity as random if you do not know of any pattern or model that can account for its variation.”

## Motives for communicating uncertainty

The considerations above show us how uncertainty and projections are closely linked. The reasons for communicating uncertainty to users are numerous: it is a standard for good science, it is essential for good decision making, and many users want the uncertainty to be communicated, contrary to what is often thought. These reasons are examined further here.

[11] A more refined list of the sources of uncertainty can be found in Lee (1998), namely: Branching process, innovation in the process, accuracy of data used, model specification, parameter estimates, future policy decisions, structural change in society and catastrophes.

## *Uncertainty as a requirement in science*

The communication of uncertainty is an obligation in several scientific domains. Formally, this requirement is promoted in the *Guide to the expression of uncertainty in measurement*[12], which stipulates:

> "When reporting the result of a measurement of a physical quantity, it is obligatory that some quantitative indication of the quality of the result be given so that those who use it can assess its reliability. Without such an indication, measurement results cannot be compared, either among themselves or with reference values given in a specification or standard." (JCGM 100:2008, p.viii)

The guide establishes general rules for evaluating and expressing uncertainty in measurement. It promotes the disclosure of procedures by which statements of uncertainty are made and the use of standard methods for international comparison (Ibid. 2008).

Population projections are often used as inputs into research or other types of forecasts. Communicating detailed information about uncertainty in projection disseminations can help said analysts to acknowledge and integrate it into their own work.

Finally, an effective communication of uncertainty should inform users about how uncertainty is inherent to population projections and how the two cannot be dissociated. A clear message related to uncertainty or derived prediction intervals should then be seen as an output of population projections just like population size and composition, a component to which demographers should allocate resources.

## *Uncertainty as a key factor in decision making*

It is not only the projected population and its structure that is of interest for planning but also an assessment of how uncertain they are. Uncertainty is a critical part of decision making. Organizations engage in risk management operations to measure and manage the consequences that some internal or external factors could have on the realization of their objectives. Typically, risk management provides an evaluation of risks, defined as the effect of uncertainty on an organization (ISO Guide 73:2009), measured based on its impact on the objectives and their probabilities of occurrence. For example, the International Organization for Standardization (ISO) provides a formal framework for risk assessment in order to determine whether the magnitude of risks is acceptable or tolerable (ISO 31000:2009).

Another reason for communicating uncertainty is that the responses to uncertain events may often be very different than responses to more certain events. In some cases, uncertainty may lead to postponement of action, precautionary measures or policies that can be adapted as the future unfolds (NRC 2000). For example, the use of the *precautionary principle,* a guiding principle adopted in several domains internationally such as the environment (Kriebel et al. 2001), health (WHO 2004) and more generally in economics and politics (Commission of the European

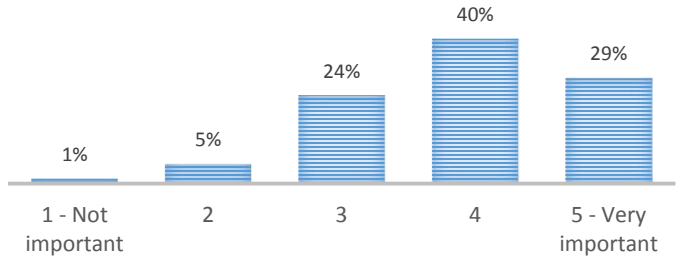
[12] The guide was prepared by a joint working group consisting of experts nominated by the Bureau international des poids et mesures (BIPM), the International Electrotechnical Commission (IEC), the International Organization for Standardization (ISO), and the International Organization of Legal Metrology (OIML).

Communities 2000), suggests mitigation or preventive measures when it is impossible to assess scientifically and with sufficient certainty the risk of an action.[13]

## *Users want uncertainty to be communicated in some form*

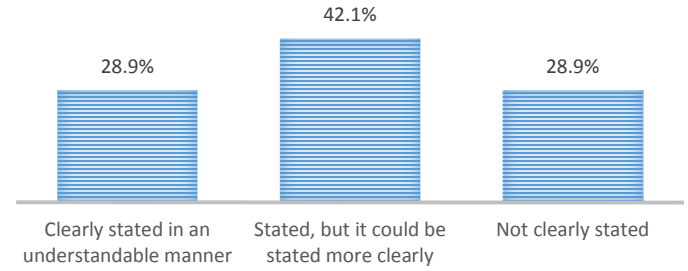
Results from the *user survey* bring support to the importance of conveying some measurements of uncertainty in projection disseminations. Although very few agencies provide quantification of uncertainty[14], it appears that the majority of user respondents (69%) felt the quantification of the uncertainty of the projections was either important or very important, while very few (1%) felt this was not important at all (Figure 8).

**FIGURE 8**




Results from the *user survey* also show that a majority of users thought the communication of uncertainty could be improved (Figure 9). The results show that less than a third of respondents (28.9%) stated that the uncertainty was clearly stated in an understandable manner.[15] The same proportion said that it was not clearly stated, and about two-fifths said that it could be stated more clearly. The fact that the majority of user respondents were interested in understanding the uncertainty of population projections further emphasizes the need on the part of NSOs to invest resources in improving the communication of uncertainty to users, for both deterministic and probabilistic projections.

**FIGURE 9**




[13] A working definition of the *precautionary principle* has been written by UNESCO (2005): "When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm."

[14] Most agencies publish a provision of scenarios supposed to provide a plausible range of outcomes, as shown in Figure 6 later in this report.

[15] All users were from countries in which population projections contain more than one scenario.

# Key recommendations and good practices

## Key recommendation 3.1: Address uncertainty explicitly

From what precedes, it can be seen that there are several motives for communicating uncertainty and that most NSOs use some means to convey it. In the rest of this chapter, some key recommendations and good practices are identified that can help to efficiently and effectively communicate uncertainty. These good practices should be seen as representing a continuum, going from the simple advice of stating upfront the uncertain nature of population projections to the provision of fully probabilistic projections. It should be noted however that some subsequent key recommendations and good practices related to transparency, communication of results and interaction with users also touch on the issue of uncertainty; these specific good practices are addressed in the relevant chapters.

### Good practice 3.1.1: Clearly state the uncertain nature of the projection results in high-level dissemination materials

One way to highlight the uncertain nature of projections is to talk about it in a simple, clear and candid manner upfront in the high-level or summary dissemination materials (Wardekker et al. 2008). It can't be expected that people will understand uncertainty if it is not summarized for them (Fischhoff 2013, Campbell 2011). Offering a frank discussion on the concept of uncertainty and how it may affect the interpretation of the results can be particularly useful for a lay audience. Situating a statement about uncertainty in high-level dissemination materials can also increase its chances of being picked up by journalists, and thus the chances for the coverage to be balanced and informative. A statement on uncertainty does not have to be made using a specific quantity or measure. On the contrary, this message should be short and accessible, and make the public aware of the speculative nature of projections.

In addition, a short introductory section of this nature could explain how uncertainty affects the results, how it is dealt with in the context of a given projection, and guide readers through the various sections where uncertainty information is disclosed. It could also be the occasion to proceed to an assessment of what is known and what is highly uncertain, and to summarize the main sources of uncertainty, which could be discussed more in detail later in other parts of the dissemination, as per the concept of *Progressive Disclosure of Information* discussed in more detail in good practice 1.1.2 (Section 4.1 - Dissemination of results).

A search of the most recent disseminations among NSOs indicates that many have already embraced, to different degrees, the practice of producing high-level summary information about the uncertainty of projections. The references listed in Box 3 offer numerous good examples of NSOs communicating the uncertainty of population projections. Some particularly useful strategies being used by various NSOs include:

- Noting that projections are not intended to be predictions about what will happen in the future nor do they describe an inevitable outcome;
- Encouraging users to use a range of projection estimates rather than a single point estimate (by considering several scenarios instead of only one when more than one scenario is published or by using prediction intervals in cases of probabilistic projections);

- Noting that the accuracy of a projection depends on a number of factors that are difficult or impossible to anticipate, such as economic crises, wars or natural catastrophes;
- Noting that the projections do not take into account non-demographic developments or factors, including changes in major government decisions (if applicable), nor do they attempt to project such developments;
- Providing some guidelines on how the projection results could be used (e.g., as a supporting tool for decision making under the assumption that current demographic trends continue);
- Noting, as Romaniuc (2010) wrote, that a projection is "a tool of managing or creating rather than discovering the future".
- Noting that projections are uncertain and become increasingly so with the length of the projection horizon (e.g., uncertainty is much greater for cohorts who have not yet been born as assumptions about future fertility patterns must be made);
- Explaining differences in plausibility of any "what-if" or sensitivity analyses as opposed to the main scenario, if applicable;
- Directly answering user questions, e.g., "Which series to use", which then explains that using several scenarios provides a more realistic picture of possible future population developments;
- Noting the core differences between population estimates and population projections;
- Noting that certain projection components contain more uncertainty than others and why (e.g., immigration levels are subject to policy changes, smaller population regions are more difficult to predict than larger ones, historical emigration estimates suffer from data quality issues are more than other projection components, etc.);

**Box 3: Some approaches used by NSOs to communicating high-level information about uncertainty in population projections**

Australian Bureau of Statistics. "1500.0 – A guide for using statistics for evidence-based policy, 2010". First Issue, Released 20/10/2010. **http://www.abs.gov.au/ausstats/abs@.nsf/mf/1500.0** Accessed December 15 2015.

Instituto Nacional de Estadistica. "Population Projections: Notes on the results". 2014-2064 Series. Published 28/10/2014. http://www.ine.es/en/inebaseDYN/propob30278/propob_inicio_en.htm Accessed December 15, 2015.

Office for National Statistics. "Frequently Asked Questions, 2014-based National Population Projections". 29 October 2015. http://www.ons.gov.uk/ons/dcp171776_420476.pdf Accessed December 15 2015.

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### Good practice 3.1.2: Help users better understand uncertainty and its interpretations

The uncertain nature of population projections calls for a minimal understanding of related concepts such as assumptions, scenarios, plausibility and uncertainty itself, all of which can be considerably complex. The general concepts of forecasts or projections, and what we can expect from such exercises, are often misunderstood. In fact, the conceptualization of ideas such as chance and uncertainty has been a challenge ever since Bernoulli introduced his ideas of on probability in the early 18$^{th}$ century (Fischhoff 2013 P.69).

While it is useful to have all concepts related to uncertainty included in an accessible glossary within the disseminated material, a good practice is to provide a dedicated section of the

dissemination materials to information aiming to educate people on how to understand uncertainty in more depth.[16] This section on the communication of uncertainty could also be the occasion to engage in a more direct and informal dialogue with users. Showing not only expertise but also a real desire to teach and care about users is likely to remove the emotional distance between experts and lay public and to increase trust. Box 4 provides examples of good practices in communication of concepts of uncertainty related to projections.

**Box 4: Example of good practices in the communication of concepts of uncertainty related to projections**

**Uncertainty in Population Projections". Postnote Number 438**
This note, published by the Parliamentary office of science and technology in United Kingdom, provides a description of how population projections work, a short assessment of past projections, a discussion of the limitations of various models of projections and guidance in terms of how to manage uncertainty in a policy context.

**LINK:** *http://researchbriefings.files.parliament.uk/documents/POST-PN-438/POST-PN-438.pdf*

**The United Nations Probabilistic Population Projections: An Introduction to Demographic Forecasting with Uncertainty**
In this paper, Alkema et al. (2015) explain how the uncertainty associated with fertility and mortality was quantified with the use of Bayesian probabilistic projections in the official population projections for all countries to 2100 released by the United Nations in 2014.

**LINK:** *http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4662414/*

**Understanding Population Projections: Assumptions Behind the Numbers, Policy Brief, Population reference Bureau, July 2014**
In this paper, the authors encourage policymakers and planners to understand the how projections rely on assumptions about the future and the implications of uncertainty for successful planning. They examine the population projections produced by the United Nations (World Population Prospects: The 2012 Revision) in order to describe how uncertainty comes from a variety of sources and how it increases over time. Finally, the authors also debunk some myths about projections (e.g. the growth of a country does not stop immediately once its fertility reaches replacement level).

**LINKS:**
http://www.prb.org/Publications/Reports/2014/united-nations-population-projections.aspx
http://www.prb.org/pdf14/understanding-population-projections.pdf

[16] For example, Woloshin et al. (2007) found that when provided a booklet about how to understand risks and the possible benefits or harms from an intervention, data interpretation skills among patients were improved considerably.

### Good practice 3.1.3: Pay particular attention to expressions of uncertainty in words

Words can be an effective way to convey a general idea of uncertainty. In general, verbal expressions are more easily remembered than numeric expressions and are more adapted to lay audiences (Kloprogge et al. 2007). The main downside is that verbal expressions are subject to different interpretations by different people, and that the result is dependent on the context (Morgan and Henrion 1990); though, as noted by Renooij and Witteman (1999), this also occurs in the case of numeric expressions.

One way to speak more clearly to lay audiences is to avoid complicated terminology. Rawlins (Sense about Science 2012) suggests to use the reciprocal of uncertainty, and talk about confidence. While this may not be appropriate for precise projection results, a general statement about the whole projections could go a long way in expressing the speculative nature of projections. For instance, it could be stated that the authors of the projections are confident that the range of the various scenarios cover a plausible range of outcomes given current and recent demographic trends and the actual population size and composition.

Qualitative assessments and evaluations also seem appropriate when quantitative measurements are impossible to provide (IPCC 2010). They are especially relevant to communicating a level of confidence, such as confidence expressed by a small group of experts in regards to the plausibility of assumptions. Some simple strategies for communicating unquantifiable uncertainty in words include:

- Describe a range of results rather than a single estimate (when multiple scenarios are provided) or a confidence interval (when probabilistic projections are made);
- Use conditional phrasing so to integrate uncertainty within the message;
- State that the results are not predictions and that the report contains more information regarding the uncertainty of the results;
- State divergences of judgements in regards to main assumptions or events that can influence the results;
- State how a given results could change given variations in demographic trends or unexpected events (e.g.: population ageing could be robust but could be lessened given higher fertility).

Benefits of verbal expressions can also be achieved in the case of probabilistic projections by using fixed scales in which calibrated language is used to express probabilistic estimates. For example, IPCC (2010) uses a likelihood scale in which linguistic qualifiers like “virtually certain” and “very likely” are associated with ranges of probabilities such as >99% and 90%-99% respectively. Disadvantages of fixed scales are that the terms are forced upon the user, not necessarily matching how they would have intuitively used them, and that like numeric expressions, they are less adapted to difficult-to-quantify uncertainties (Kloprogge et al. 2007).

### Good practice 3.1.4: Consider and acknowledge the major sources of uncertainty.

There are so many interacting factors that can be sources of uncertainty that it would never be possible to identify them all. However, as much as possible, the major sources of uncertainty in population projections should be communicated to and understood by users. The most important sources should be the topic of more in-depth analysis when possible. Uncertainties that are unquantifiable but relevant should be listed and subject to a general discussion about their (estimated) general importance. These practices would reinforce the statement that population projections are not predictions and the general transparency of the projections. The following are possible sources of uncertainty in population projections:

- **Uncertainty related to data**: This uncertainty includes the imprecisions in the data used in the construction of the projection such as the base population and the past vital rates used for assumption-building.
- **Uncertainty of the future**: This is the uncertainty based on how the assumptions of the projections will reflect the future. This type of uncertainty increases with time. It can include the occurrence or non-occurrence of some events such as new policies that can affect future demographic trends or simply the rates at which people will die. Not knowing the future forces us to frame these in terms of probability and plausibility.
- **Structural uncertainty**: This relates to our limited understanding of population dynamics and capacities to model them.17 Experts tend to underestimate this structural uncertainty that is inherent to systems and processes (Morgan et Henrion 1990). Possible sources of structural uncertainty are:
  - Lack of scientific knowledge
  - Limitations/boundaries of the modelling processes
  - Events with low probability that are not considered in the modelling process
  - Limitations of indicators used in the modelling process

NSOs should invest efforts in the evaluation of their projection program with regard to these sources of uncertainty and recognize the associated strengths and weaknesses in dissemination materials.

### Good practice 3.1.5: Solicit and publish expert opinion

Formal expert elicitation can be considered a structured approach to consulting experts on a subject where there is insufficient knowledge or uncertainty is great (Knol et al. 2010). In the context of modeling uncertain events, elicitation can be used to translate someone's judgment about those uncertain events into something that can be usefully modeled (Gosling 2014).

[17] A patent example in population projections would be the difficulty in distinguishing quantum and tempo effects in examining past fertility trends. Interrelationships between family size and the timing of births in period fertility measures make it very difficult to infer cohort fertility (e.g. van Imhoff 2001) and can only be replicated using microsimulation techniques (Le Bras 2008).

Eliciting the views of experts is indeed often the only viable option when a decision must be made in the absence of empirical data, or when the required data is limited, unreliable or prohibitively expensive (Allan et al. 2010; Runge et al. 2011). Particularly when the value of an uncertain quantity is needed, and data limitations prevent the use of statistical techniques to produce probabilistic estimates, in many cases the only remaining option is to ask experts for their best professional judgment (Morgan and Henrion 1990).

However, expert elicitation should not be viewed as a mere "last recourse", as it offers several benefits. When properly structured and documented, expert elicitation offers in many cases greater transparency in addressing uncertainties than other conventional statistical techniques (Knol et al. 2010). It is also relatively quick and inexpensive to obtain as compared to intensive research or data collection (Ibid, Gosling 2014). Further, in some cases, expert elicitation methods may be preferable over other methods such as time series extrapolation if they take into consideration additional factors other than what has previously been observed. According to Lutz et al. (1998), this argument applies particularly well to the case of population projections, as demographic trends are highly affected by social changes that can be very difficult to predict based purely on historical trends.

Expert elicitation should not be considered a precise science, as it can be difficult for experts to articulate their views (Gosling 2014). This is especially true when experts are asked to assign probabilities to specific events; it has been found that humans, whether expert or not, are generally not good at estimating probability (Morgan and Henrion 1990, Garthwaite et al. 2005, Kynn 2008). Faced with such tasks, individuals have to resort to heuristics devices that can lead to biased outcomes (Morgan and Henrion 1990). These possible sources of biases are summarized in Box 5.[18] Projection producers who utilize expert elicitation should be aware of these limitations.

On the other hand, building projections requires that some form of expert judgment be made—whether on the choice of method or the assumptions about each projection component. At the very least, the use of expert elicitation expands the number of persons involved in providing judgments; there is evidence that simply averaging the independent judgments of several experts tends to result in a more accurate estimate than that derived from any single expert (Silver 2012). In the context of many NSO projection programs, where a small team of individuals may work closely together, largely in isolation from the broader community of demographers working in academia or the private sector, tendencies towards narrowed viewpoints and/or groupthink can arise. By opening up the assumption-building process to include experts working in various capacities within the broader field of demography, projection-makers can be exposed to a greater range of information and informed viewpoints, which should ultimately improve the credibility of the projection assumptions.

Different protocols have been created to facilitate the processes of expert elicitation. No clear single approach or technique of eliciting expert opinion which can be considered 'best' and the choice of approach should be based on the characteristics, circumstances, intended use and

[18] More information on these heuristics can be found in Kahneman and Tversky (1982), Morgan and Henrion (1990), Hoffman et al. (1995), Kynn (2008) and Martin et al. (2011), among others..

available resources of the exercise at hand and based on professional judgment (Knol et al. 2010; Morgan and Henrion 1990).[19]

**Box 5: Some biases to be aware of when soliciting expert judgment**

Both the reliability and validity of expert estimations are impacted by the influence of various forms of bias. The main types of bias and/or heuristic devices that can hinder expert judgment include (Morgan and Henrion 1990; Hoffman et al. 1995; Kynn 2008; Lutz et al. 1998; Martin et al. 2011):

- **Availability/Accessibility bias:** The estimated probability of an event is based on familiarity/cognitive availability rather than objective frequency. Alternatively, the tendency to assign excessive weight to the first evidence obtained.
- **Anchor and Adjustment bias**: Estimates are anchored to a natural starting point or benchmark and as a result, don't vary much from it.
- **Confirmation bias**: The tendency to seek evidence that confirms the current hypothesis. A related bias is the desire to maintain consistency even if it means ignoring important information.
- **Representativeness bias:** An overestimation of the frequency of rare events and/or an overreliance on variables that have extreme values. Alternatively, expecting the fine details to reflect the larger process while ignoring or paying insufficient attention to background information such as base rates.
- **Hindsight bias:** The tendency to exaggerate the predictability of reported outcomes and ignoring the possibility that things could have turned out differently.
- **Motivational bias**: Stems from personal beliefs or interests.

## Key recommendation 3.2 Provide a range of results in order to reflect the uncertainty of projections.

Most users of population projections are interested in single most likely outcome (Lutz et al. 1994), and will tend to interpret the result of a middle variant as such when more than one projection is provided (Keyfitz 1981). Despite these practices, most NSOs publish ranges of outcomes rather than single estimates, in order to communicate the uncertainty associated with population projections. This plurality of outcomes forces users to understand that there is more than one possible future.

There are mainly two ways adopted by NSOs to provide multiple outcomes. The most common way to produce several outcomes is to provide several deterministic scenarios each containing different sets of assumptions. Each scenario lends a single trajectory, but their multiplicity provides a range of outcomes. Another way, less popular but enjoying increased recognition among NSOs and in the literature, is to produce probabilistic projections (in opposition to deterministic projections described above), in which a single forecast is produced surrounded by a

[19] Examples or summaries of such protocols can be found in Morgan and Henrion (1990), Hoffman et al. (1995), Collopy et al. (2001), van der Sluijs et al. (2004), Garthwaite et al. (2005), Scapolo and Miles (2006), Aspinall (2010), Knol et al. (2010), and Fischhoff and Davis (2014), among others.

prediction interval. In this case, the parameters are not single values but rather probability distributions. There may be an infinite number of trajectories each reflecting different values picked for the probability distributions of the various components of the growth.[20]

The dissemination of multiple deterministic scenarios or the provision of prediction intervals are two distinct good practices in order to communicate the uncertainty of population projections, each having its strengths and weaknesses, and promoting a distinct way to handle uncertainty.

### Good practice 3.2.1: Disseminate several scenarios/variants

The provision of several scenarios/variants makes it clear to users that there is not one single possible outcome for the future but rather multiple possibilities. It is the most used method to communicate uncertainty by the NSOs sampled in the *NSO survey* (as seen in Figure 5 earlier). Comparisons of multiple scenarios allow users to understand the sensitivity of the projected results to some changes (sometimes plausible, other times more hypothetical or policy-driven) in vital rates. Such analyzes, called sensitivity analyzes, are useful to guide potential interventions or policy development. Given its relative simplicity to produce and intelligibility for users, the provision of multiple scenarios should be a common practice among projection makers. Even those NSOs that produce probabilistic projections may have interest in providing results from sensitivity analyzes.[21]

An important drawback of the method is the probabilistic inconsistency of the scenario intervals in regards to different projected outcomes. Indeed, the most common practice among NSOs is to build a low-growth and a high-growth scenario by combining various assumptions so that the interval between the two in regards to population size will be considered the largest plausible future range. For example, a low-growth scenario will be constructed by combining assumptions of low fertility, high mortality, low immigration and high emigration. This high-growth/low-growth configuration is likely to provide acceptable ranges in terms of population sizes but has been shown to yield very narrow ranges in regards to the total dependency ratio or the old age dependency ratio (Lee 1998, Keilman and al. 2002). As Lee (Ibid.) explains, there can be several combinations of levels of fertility, mortality and migration leading to a given interval of population sizes, but the results in terms of the projected age structure can differ substantially from one combination to another.

It is therefore recommended that the provision of multiple scenarios be guided by a comprehensive strategy in terms of communicating uncertainty, one that comprehends multiple facets of the results, such as population sizes, geographical distribution, various age structure indicators, etc. It will be difficult in practice to consider all possible aspects of the results, so their choice should be guided by specific policy preoccupations in specific countries, such as population

[20] Typically, a large number of projections are run using Monte-Carlo simulations in order to obtain a more probable forecast (the median of all iterations) and a prediction interval (given a chosen percentile).

[21] As Sanderson et al. (2003) show, the results of probabilistic projections can be aggregated so as to produce alternative scenarios and conduct rich sensitivity analyses.

ageing, renewal of the labour force, sizes of migration flows, etc. Additionally, NSOs should communicate clearly which aspects were considered and which ones were left out in their strategy.

Providing consistently large intervals for a plurality of results and indicators involves computing various combinations of fertility, mortality and migration levels. Another option proposed by Caswell and Gassen (2015) is to use matrix algebra to compute the sensitivity and elasticity (the proportional sensitivity) of various projected outcomes to changes in the vital rates of a projection. The method provides consistent results for any indicator that can be obtained without the need to compute several scenarios.

NSOs are often asked by users for various scenarios to facilitate sensitivity analyses, and results from the *user survey* showed that many users were interested in having the capacity to build their own combinations of assumptions through an interactive web module. While this may seem like very difficult to build, such applications already exist, and are discussed see good practice 1.1.8 (in section 4.1). One difficulty is that such applications provide means to compute a very large number of distinct and possibly diverging scenarios, which can create confusion different scenarios. A user can then choose the scenario that best suits his interests and use it as an official projection made by the NSO. For these reasons, it is recommended to compel users to identify their scenarios as the result of their own assumptions.

### Good practice 3.2.2: Provide prediction intervals

The provision of several distinct scenarios has been increasingly recognized as an unsatisfactory way to deal with the question of uncertainty in population projections (Lutz et al. 2004). One caveat of the method is that it makes it impossible to attach a probabilistic interpretation to the resulting scenarios (Lee 1998, NRC 2000, Keilman et al. 2002) as no probabilities are attached to the intervals produced, limiting their usefulness for planning purposes. It is not possible, for instance, to modify the width of the high-low interval for some specific purposes. The scenarios themselves are also difficult to interpret: since they assume perfect correlations between various components of population growth, they do not represent very plausible outcomes.

Probabilistic projections are seen as a way to correct for these issues, as they are a means to integrate in a consistent manner the uncertainty associated with each component of population growth and summarized by non-comparable indicators (e.g. total fertility rate, life expectancy, etc.). In probabilistic projections, the inputs are not single values but probability distributions, built in most cases from time-series extrapolations, expert elicitation methods or analyses of past forecast errors. The result is, for any outcome possible (population size, size of different age groups, age structure indicators, etc.), one forecast, usually representing the median result, surrounded by a prediction interval. Thus, it is not necessary to assume perfect correlations between components, contrary to what is done with the creation of multiple scenarios.[22]

[22] This is obviously a very cursory view of the process. Useful summaries can be found in Lee (1998), de Beer (2000) and Keilman et al. (2002). Examples of probabilistic projections can be found in: Alho and Spencer (1985), Stoto 1983, Lee and Tuljapurkar (1994), Lee (1998), National Research Council (2000), Tuljapurkar et a. (2004), Keilman (2008), Abel et al. (2010), Raftery et al. (2014).

Assuming that appropriate assumptions are made about the temporal autocorrelations of demographic rates, probabilistic projections are better equipped to simulate how uncertainty unveils over the course of the projection than deterministic scenario (which tend to assume straight trajectories between the initial and target levels) (Lee 1998). Probabilistic projections are often seen as better suited to respond to different types of users and needs. Indeed, equipped with a probability distribution, users can tailor a prediction interval according to their sensitivity to uncertainty (Keyfitz 1972, Raftery 2014).

Results from the *user survey* also provide some support for the provision of probabilistic projections showing that users seem to desire some quantification of the uncertainty of population projections. As shown in Figure 8, more than two-thirds of respondents (69%) felt that it was either important or very important to provide a quantification of the uncertainty of the projections, while very few (1%) felt this was not important at all.

A clear advantage of probabilistic projections is a more precise communication of uncertainty. Fundamentally, because probabilities don't exist in the nature - they are rather created due to our lack of knowledge as a means to express uncertainty -, probabilistic projections can be seen as constituting a more honest representation of the limits of our predictive abilities (Silver 2012). The responsibility of demographers to clearly state their limitations in population forecasting was recognized by Keyfitz (1981), who stated: "Demographers can no more be held responsible for inaccuracy in population forecasting 20 years ahead than geologists, meteorologists or economists when they fail to announce earthquakes, cold winters, or depressions 20 years ahead. What we can be held responsible for is warning one another and our public what the error of our estimates is likely to be".

However, the probabilistic approach also carries some important limitations. Perhaps the most important one is the difficulty to interpret the probabilities. As Romaniuc (1994) observes, the theoretical foundation for probabilistic projections is not clear, stemming in large part from the elusive nature of uncertainty in population projections discussed in the introduction of this report.[23] Any prediction intervals will therefore include some but not all quantifiable aspects of uncertainty, but exactly what is left out can only be partially defined.

The interpretability of the prediction interval is not always straightforward. Depending of the data sources used for their computation, intervals can be interpreted as divergences of opinions among

[23] Romaniuc suggests two possible interpretations, one in which there would be some laws governing the future of population but accidents or human actions could create random departures from some average trend, and a second one in which a projection could be thought as a random sample of projections drawn from a much larger sample of projections, and from which some prediction intervals are computed.

experts, variability in past estimates, errors in past projections, or as a combination of these sources.[24,25]

Another limitation of probabilistic projections has to do with the finding from behavioral research that people are not able to interpret intervals well enough to extract key information. There are, for instance, known biases in the perception and evaluation of uncertain outcomes (e.g. Kahneman and Tversky 1979).[26] However, there are also indications from cognitive research that probabilistic projections can generally be well understood by people and lead to better decision-making (Raftery 2014).

The level of effort and resources required for the production of probabilistic projections constitutes a severe impediment for NSOs, operating with limited resources. To this date, most existing probabilistic projections stem from large undertakings that mobilized important and specialized teams of demographers.[27] Lee (1998, p.189) observed that "both the production and the use of probabilistic population forecasts are in their infancy, and we can expect to see a great deal of progress in both areas during the next decade." Almost two decades later, the situation has evolved, but not to the point where a consensus can be established as to what are the best methods for producing probabilistic projections. It is therefore hopeful that research will continue in this field in order to pursue the development of probabilistic projections and facilitate their spread and use.

Compared to the provision of multiple deterministic scenarios, probabilistic projections provide a more ostensibly confident assessment of uncertainty. However, the level of information provided by prediction intervals may lead users to infer greater precision than what is intended (Fischhoff and Davis 2014).[28] For example, measures of uncertainty will be appropriate only if the statistical model behind is a (very) good approximation of the underlying process it searches to simulate (and will continue to apply in the future), which is not straightforward to assess.

In light of the considerations above, a well-guided approach is for NSOs to evaluate carefully their capacity to implement such methods without compromising the overall quality of their projections. In particular, precise measurements of uncertainty should be provided only when

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[24] Such difficulties have been well documented in the field of meteorological forecasts. For example, the results of several surveys in the United States have shown that the public has difficulty interpreting probabilities of precipitation, even though such probabilities have been published since the 1960s (Morss et al. 2008): in a survey conducted in 2008, less than one respondent in 5 were able to find the correct interpretation of the sentence "There is a 60% chance of rain for tomorrow". The correct interpretation is "it will rain on 60% of the days like tomorrow" (Morss et al. 2008).

[25] Methodologies can vary too. For example, two major endeavours in regards to probabilistic projections are the world population projections produced by the United Nations (United Nations 2015) and the International Institute for Applied Systems Analysis (IIASA) (Lutz et al. 2004), use different data sources and distinct methodologies. Tuljapurkar et al. (2004) provide a useful comparison of two main methodologies for probabilistic projections.

[26] See box 5 for examples of possible biases in the evaluation of uncertain outcomes.

[27] A simpler option is propose by Goldstein (2004). Goldstein proposes a compromise methodology allowing one to attach probabilistic interpretations to already-existing scenarios and to combine the associated uncertainty to projected age groups in a probabilistically sensible manner.

[28] Note that Stoto (1988) objects this, stating that the point is not one in estimation but in communication. In other words, prediction intervals may be wrong, but they serve to communicate more precisely the intentions of projection makers.

projection makers are confident in their capacities to build scientifically sound confidence intervals, based on robust data, solid expertise and somewhat standardized methods, to the extent where such a consensus exists. When probabilistic projections are produced, it should be made very clear how the prediction intervals were computed and to what they refer (what were the sources (data) used to quantify the uncertainty). Finally, users should be made aware that the probabilities attached to the forecast are itself a forecast, that they take into account only some parts of the quantifiable uncertainty, and that the proportion of what is included and what is excluded cannot be measured with certainty either.

## 4.4 Fostering relationships with users

### Introduction

Good science communication must begin with aiming to understand audience needs and how to address those (National Academy of Sciences 2014, Bruine de Bruin and Bostrom 2013, Fischhoff 2013). Interactions with users provide an opportunity to determine if the communications are well understood and can lead to improvements when they are not. Interactions can also help to determine whether the communication approach responds well to the needs of users in general and can trigger important changes in that regard. Direct communication with scientists and the impression of accessibility can improve their perception in the eyes of users, for whom scientists are often seen as competent, but cold (National Academy of Sciences Ibid.). Hence, for all these reasons, it is more and more recognized that effective scientific communications must be a two-way process.

One way to approach the public is the media. A wide and accurate media coverage involving both traditional and new media can be helpful to communicate messages effectively and to reach new audiences. It is therefore critical to understand how media in all forms work and to cultivate good relationships with journalists.

### Key recommendations and good practices

**Key recommendation 4.1: Foster relationships with users**

The following good practices should help NSOs to foster their relationships with users, which should improve users experience with the product and enhance the pertinence of the projections. The attitudes and the actions of the experts working in the NSOs have a large part to play in the communication process as they are the ones entering in contact with the public (Davies 2008).

#### Good practice 4.1.1: Provide a clearly-identifiable means for users to contact projection producers

Requests for technical assistance from users can shed light on areas for improvement in disseminations. Among the respondents to the *user survey* who had previously contacted their NSO for information requests, 90% felt that their NSO provided an adequate response to their request(s). This suggests that generally, interactions between NSOs and users are fruitful and productive from the user point of view, and therefore should be encouraged on the part of NSOs.

It is therefore recommended that NSOs consider taking the following interrelated actions in regards to fielding requests from users:

- Provide a clearly-identifiable means for users to ask questions and provide feedback to projection producers, and respond to requests in a timely manner on the NSO's website.
- Identify common themes in customer queries and provide responses to frequently asked questions or items known to be less understood in the dissemination material.

### Good practice 4.1.2: Consider developing and offering "outreach activities" to engage directly with users in a substantive manner

NSOs may wish to consider engaging in outreach activities involving direct contact with users such as instructional workshops, training sessions or online chat sessions in order to improve user understanding of projections. In terms of successful strategies for communicating to users, several respondents to the *NSO survey* mentioned that the use of outreach activities such as these proved to be most successful strategy for communicating to their users. The use of more in-depth, interactive communications provide an opportunity to reveal misconceptions or misinterpretations that users may have about the projection results, identifying in more specific and clear terms areas where communication improvements could be made. There is in fact some evidence from the literature that direct instruction by scientists generates positive reactions among members of the public (National Academy of Sciences Ibid.).

Outreach activities can also help to boost the credibility of projection makers and NSOs in general. Indeed, activities such as discussing, teaching and simply sharing information express trustworthy intentions, which is capital as trust is, with expertise, the ingredients to scientists credibility (Fiske and Dupree 2014).

### Good practice 4.1.3: Provide notices of forthcoming projection releases to media and frequent projection users.

NSOs should make efforts to distribute notices to media and frequent projection users informing them of forthcoming projection dissemination releases. The popular media in particular play a vital role in communicating science to the public; indeed, the majority of citizens gain knowledge about scientific findings through the media.[29] Projections are uniquely subject to confusion regarding what edition is the most current, given that their titles typically refer to dates that are in the future. Several respondents to the user survey mentioned that the communication of the projections could be improved in this regard. It is thus recommended that NSOs ensure that the most recent edition of the projections is the one used by media and other prominent users perhaps by improving/targeting search capabilities within the website. Furthermore, previous editions should be clearly labelled and categorized as "ARCHIVED" (or an equivalent term) material within the NSO website, with a hyperlink to the current edition on the same page.

### Good practice 4.1.4: Embrace traditional and new media

For scientists, communicating with the public is often negatively perceived as a difficult and perilous duty (Davies 2008). However, popular media should be seen as a major channel for

[29] The Social Issues Research Centre and the Amsterdam School of Communications Research. *Guidelines for scientists on communicating with the media.* http://www.sirc.org/messenger/

scientists to perform their responsibility of communicating with the public (ECCR 2007). Indeed, the quality of press releases have been shown to have an impact on the quality of subsequent news reporting (Schwartz et al. 2012). A proactive approach in this domain can help provide an accurate and balanced picture to the public and avoid possible pitfalls and misunderstandings, which could hinder trust from the public. Unfortunately, while there is strong evidence that interaction with the scientific community is considered to be productive for the media, those contacts appear to be rather uncommon in the scientific domain in general (ECCR 2007).

To reach their audience successfully, messages intended for general audiences should be structured in a way to help media and lay public see and understand the uncertain nature of population projections). NSOs should not assume that journalists are well equipped to do so. For example, short abstracts and press releases should highlight limitations and other information needed to understand and interpret the findings (Schwartz et al. 2012). Even those well-versed in covering scientific issues may be not aware of the special ways by which demographers work around the issue of uncertainty in population projections.

In addition to traditional media such as print, radio and television, projection makers should direct efforts towards embracing 'new', internet-based media forms including social media. As noted by Brossard and Scheufele (2013), the new norm is for the public to use the Internet to seek information about scientific issues, and new media science coverage may reach audiences not typically targeted by traditional media. While best practices in terms of online science communication are lacking at this time (Brossard 2013), projection makers should prioritize the investigation of using new media such as social networking sites, blogs and online forums to communicate dissemination materials, as they provide more opportunities for potential users to be exposed to the information (Ibid).

### Good practice 4.1.5: Make electronic dissemination materials accessible and easy to navigate

NSOs should regularly evaluate the ease-of-use and accessibility of electronically disseminated materials. Whenever resources allow, seek and implement improvements to NSO websites that will enhance data retrieval capabilities and navigational ease for users. Of course, the implementation of improvements or changes to NSO website content is often outside of the control of the persons responsible for producing population projections. Most NSO websites have common look-and-feel guidelines or other restrictions in terms of the format of web content; the implementation of any improvements or modifications is normally dependent on the availability of associated resources. Whenever the opportunity is present, however, NSOs should investigate means of improving the user experience of the population projection webpages, as well as search capabilities within the broader NSO website so that users can quickly locate the main projection webpage.

### Good practice 4.1.6: Investigate and document the needs of users

Several of the previous good practices may serve not only to provide information to users but also to gather information about what users need and what could be improved. Thus, interactions with

users should be seen as opportunities to document their unmet requirements, identify good practices to maintain, and more generally as a way to constantly gauge the pertinence of the projections.

This is not always easy in practice. I It is easier for users to contact the projection makers than for projection makers to contact users. Indeed, for the most part, users simply download projection materials from the NSO's website in an anonymous way, and there is no way for NSOs to know who has accessed or viewed their materials unless the user contacts them with an inquiry. Often, the best information NSOs have about their users is the number of web hits and/or downloads.

That said, there are some practices that can be used to maximize the collection of information from users. Here are a few:

- Provide means for users to contact experts through the NSO's website (see Good Practice 1 above)
- Engage in outreach activities such as conferences, seminars, workshops (see Good Practice 3 above)
- Establish a working group (with knowledgeable users) that can help inform methodological changes, and also keeps the users involved
- Maintain relationships with known users
- Consultations (formal or informal)
- Invite feedback whenever possible (e.g. at events, in publications, in signatures at ends of emails)

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# APPENDIX 1 – USER SURVEY

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# UNECE Task Force on Population Projections
# User Survey

## Introduction

**Dear Sir/Madame,**

**This survey is the result of an important initiative of a recently-appointed Task Force on Population Projections* within the United Nations Economic Commission for Europe**. Its purpose is to obtain information about how national population projections outputs are used and user's perspective about various aspects of the projections.**

**If you did consult population projections for your country prepared by the National Statistical Office in recent years, we ask you to support this initiative by completing the present survey. Your responses will be used in the formulation of a collection of good practices on communicating population projections and will help identifying areas for improvement in that regard. As a result, your elaboration in as much detail as possible in the comment sections of the survey is greatly appreciated and strongly encouraged.**

**If you feel that other persons in your organization might be in a better position to respond to the survey, or they could simply provide an additional perspective, please invite them to participate in the survey by forwarding the participation link.**

**You are kindly invited to complete the survey by 30 June 2015.**

**If you have any questions or concerns about the survey, please contact the representative of your National Statistical Office that invited you to participate in this survey, or send a message to "social.stats@unece.org" at your earliest convenience.**

**Thank you in advance for your assistance in this endeavour.**

**Paolo Valente**
**Statistical Division**
**United Nations Economic Commission for Europe**

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# UNECE Task Force on Population Projections
# User Survey

## Classification questions

**INFORMATION ON THE COMPILATION OF THE QUESTIONNAIRE**

- In order to navigate through the questionnaire please use the PREVIOUS and NEXT buttons located at the bottom of each page, and not the buttons on your browser.

- The questionnaire can be filled in more than one session.

- Clicking on the PREVIOUS and NEXT buttons at the bottom of each page saves automatically the data entered. However, the information entered can be corrected later, if necessary.

### 1. Please provide the following identification information (optional):

to be used only for the purpose of this survey

Name (optional)

Affiliation (optional)

Country

Email address (optional)

### 2. How would you categorize yourself/your organization?

- ◯ Private sector
- ◯ Government (National)
- ◯ Government (Regional/municipal)
- ◯ Research group
- ◯ School/University
- ◯ Media
- ◯ Non-governmental organization
- ◯ Other (please specify below)

Please specify or provide comments:

3. How would you rate your level of familiarity with population projections?

◯ High ◯ Intermediate ◯ Low

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# UNECE Task Force on Population Projections
# User Survey

## Core questions

4. For what purpose do you use projections?

Indicate all that apply.

- [ ] Planning
- [ ] Research
- [ ] Education
- [ ] Reference for building own population projections
- [ ] Reference for building own projections (of characteristics other than population)
- [ ] Other (please specify below)

Please specify or provide comments:

5. Using a scale from 1 to 5, where 1 is “of no importance” and 5 is “very important”, please rate the importance of the following elements in regards to your use of population projections :

| | 1 - Of no importance | 2 | 3 | 4 | 5 - Very important |
|---|---|---|---|---|---|
| Information about the current demographic context/trends | ○ | ○ | ○ | ○ | ○ |
| Information about the assumptions | ○ | ○ | ○ | ○ | ○ |
| Information about the methodology | ○ | ○ | ○ | ○ | ○ |
| Information about the quality of the underlying data sources | ○ | ○ | ○ | ○ | ○ |
| Detailed analysis of the results | ○ | ○ | ○ | ○ | ○ |
| Visual description of results (graphs) | ○ | ○ | ○ | ○ | ○ |
| Customizable data table | ○ | ○ | ○ | ○ | ○ |
| Summary information about the results (e.g., highlights) | ○ | ○ | ○ | ○ | ○ |
| The provision of a set of several different scenarios/variants | ○ | ○ | ○ | ○ | ○ |
| The designation of a “best” or “most likely” scenario/variant | ○ | ○ | ○ | ○ | ○ |
| Detailed projection data (e.g., data tables by single year) | ○ | ○ | ○ | ○ | ○ |
| Frequent updates | ○ | ○ | ○ | ○ | ○ |
| Quantification of the uncertainty of the projections | ○ | ○ | ○ | ○ | ○ |
| Projection of characteristics other than age/sex/region | ○ | ○ | ○ | ○ | ○ |

Comments (optional)

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# UNECE Task Force on Population Projections
# User Survey

## Core questions (continued)

6. Which of the following statements best characterizes your use of population projection data?

- ◯ You primarily use data from the variant/ scenario that was labelled as most likely by the projection makers.
- ◯ While the projection makers did not identify specifically a variant/scenario as the most likely, you primarily use data from the medium variant/scenario.
- ◯ While the projection makers did not identify specifically a variant/scenario as the most likely, you primarily use data from a variant/scenario that you considered to be the most likely result, based on the specifications of that variant/scenario.
- ◯ You primarily use data from a variant/scenario that you specifically chose as being the most useful for your specific needs, based on the specifications of that variant/scenario.
- ◯ You use data from several variants/scenarios to obtain a range of possible future outcomes.

Comments (optional)

7. What is the time horizon for which you usually need projected population estimates?

in years

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# UNECE Task Force on Population Projections
# User Survey

## Core questions (continued)

**Please respond with reference to the most recent edition of the population projections that you used.**

8. In your opinion, the information about the current demographic context/trends is:

- ◯ Not detailed enough
- ◯ Adequate
- ◯ Too detailed
- ◯ No opinion/Not applicable

Comments (optional)

9. In your opinion, the information about the projection assumptions is:

- ◯ Not detailed enough
- ◯ Adequate
- ◯ Too detailed
- ◯ No opinion/Not applicable

Comments (optional)

10. In your opinion, the information about the projection methodology is:

- ◯ Not detailed enough
- ◯ Adequate
- ◯ Too detailed
- ◯ No opinion/Not applicable

Comments (optional)

11. In your opinion, the information about the quality of the underlying data sources is:

- ◯ Not detailed enough
- ◯ Adequate
- ◯ Too detailed
- ◯ No opinion/Not applicable

Comments (optional)

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# UNECE Task Force on Population Projections
# User Survey

## Core questions (continued)

**Please respond with reference to the most recent edition of the population projections that you used.**

12. In your opinion, the analysis of the results is:

- ◯ Not detailed enough
- ◯ Adequate
- ◯ Too detailed
- ◯ No opinion/Not applicable

Comments (optional)

13. In your opinion, the number of scenarios/variants provided is:

- ◯ Insufficient
- ◯ Adequate
- ◯ Excessive
- ◯ No opinion/Not applicable

Comments (optional)

14. In your opinion, the projection data are:

- ◯ Not easily accessible
- ◯ Easily accessible
- ◯ No opinion/Not applicable

Comments (optional)

15. In your opinion, the projection data are:

- ◯ Not adequately detailed
- ◯ Adequately detailed
- ◯ Too detailed
- ◯ No opinion/Not applicable

Comments (optional)

16. In your opinion, the uncertainty of the projections is :

- ◯ Not clearly stated
- ◯ Stated, but it could be stated more clearly
- ◯ Clearly stated in an understandable manner
- ◯ No opinion/Not applicable

Comments (optional)

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# UNECE Task Force on Population Projections
# User Survey

## Core questions (continued)

**Please respond with reference to the most recent edition of the population projections that you used.**

17. In your opinion, the frequency of projection updates is:

- ◯ Not frequent enough
- ◯ Adequate
- ◯ More frequent than necessary
- ◯ No opinion/Not applicable

Comments (optional)

18. In your opinion, the language used in the projection dissemination is:

- ◯ Too simplistic
- ◯ Appropriate
- ◯ Too technical
- ◯ No opinion/Not applicable

Comments (optional)

19. Have you ever contacted the national statistical organization for more information about the projections?

- ◯ No
- ◯ Yes

Optional comments:

20. Do you feel the national statistical organization provided an adequate response to your request(s)?

- ◯ Yes
- ◯ No (please elaborate below)

21. In your opinion, could some aspects of the communication of the projections be improved?

- ◯ No
- ◯ Yes (please elaborate below)

22. **End of the questionnaire**

Thank you very much for your participation. If you want, you may provide below any comments on the survey, in particular if you found any problems in understanding the questions, or providing the answers, or if you would like to provide additional information on any of the questions.

Paolo Valente
UNECE Statistical Division
on behalf of the UNECE Task Force on Population Projections

# APPENDIX 2 – NSO SURVEY

UNECE

# UNECE Task Force on Population Projections
# NSO Survey

## Introduction

**Dear Colleague,**

**You have been identified as the contact person for the population projections produced by your National Statistical Office.**

**We are contacting you on behalf of a recently-appointed Task Force on Population Projections* within the United Nations Economic Commission for Europe** (UNECE). The Task Force on Population Projections, which includes members from various countries along with representatives from Eurostat, UNECE and the United Nations Population Division (DESA), was created following the recommendations of an In-Depth Review of population projections commissioned by the Conference of European Statistician (CES) in 2014.**

**The main objectives of the Task Force are to (a) promote the sharing of good practices on communicating population projections and (b) create mechanisms for collecting and disseminating metadata on national and international population projections.**

**As part of the Task Force's information-gathering process, we have developed a survey to be completed by national population projection makers. The purpose of the survey is twofold:**

**• Firstly, to obtain basic information about your organization's national population projections. Your responses will be used to populate a database containing metadata about the national population projections of all UNECE member countries. This database, to be updated on a regular basis, will provide a central information access point for projection users.**

**• Secondly, to obtain information about your organization's approach to communicating population projection to users. Your responses will be used, in conjunction with a parallel survey of a sample of projection users and the ongoing work of the task force, to develop a report containing a collection of good practices for communicating population projections.**

**Your participation in this survey is essential to the achievement of the Task Force's main objectives. It is hoped that the forthcoming database and good practices report will provide useful information for all national statistical agencies involved in the production of population projections.**

**We ask that you kindly complete the present survey by 20 June 2015. If you feel that another person in your organization might be in a better position to respond to the survey, please forward to this person the participation link.**

**If you have any questions or concerns about the survey, please send a message to "social.stats@unece.org" at your earliest convenience.**

**Thank you in advance for your assistance in this endeavour.**

**Paolo Valente**
**Statistical Division**
**United Nations Economic Commission for Europe**

***http://www.unece.org/statistics/about-us/statstos/task-force-on-population-projections.html**

****http://www.unece.org/stats/stats_h.html**

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# UNECE Task Force on Population Projections
# NSO Survey

## CONTACT INFORMATION

**INFORMATION ON THE COMPILATION OF THE QUESTIONNAIRE**

- In order to navigate through the questionnaire please use the PREVIOUS and NEXT buttons located at the bottom of each page, and not the buttons on your browser.

- The questionnaire can be filled in more than one session.

- Clicking on the PREVIOUS and NEXT buttons at the bottom of each page saves automatically the data entered. However, the information entered can be corrected later, if necessary.

### 1. Please provide the following contact information for any follow-up communications in the future:

Name:

Title/position:

National Statistical Organization:

Email address (for follow up communications):

### 2. Email address for direct contact by projections users (optional):

The United Nations Economic Commission is planning to create a publicly accessible database of metadata on population projections. Each NSO may indicate (on an optional basis) an email address at which users of this database would be able to send requests in case they need information or clarification about the national projections. Only this email address, if provided, will be included in the public database.

Email address:

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## GENERAL INFORMATION ON POPULATION PROJECTIONS

**The following questions pertain to the most recent edition of national population projections produced by your organization.**

3. Please specify the month and year of the dissemination of the projections and/or related datasets (if multiple products were published over a period, please indicate the earliest date, including web dissemination):

| | Month | Year |
|---|---|---|
| Month and year of dissemination | | |

4. Please provide electronic hyperlink(s), if available, to the dissemination products (publications and/or datasets):

5. Please specify the start and end year of the projections (if different year-ends are used for different products, please provide the farthest):

Start Year

End Year

6. Please indicate the source of the data for the base population, its reference date (month and year) and information on adjustments, if any:

Source:

Reference date (month and year):

Adjustments (if any):

7. Please indicate what is the update frequency of your projections:

8. Which population characteristics, other than age and sex, were distinguished in your projections:

Indicate all that apply.

- [ ] Sub-national geography
- [ ] Marital status
- [ ] Household type
- [ ] Citizenship
- [ ] Country of birth or origin
- [ ] Ethnicity
- [ ] Education
- [ ] Language
- [ ] None
- [ ] Other (please specify below)

Please specify of provide comments:

9. Please indicate the number and type of scenarios/variants published:

- ( ) One scenario only
- ( ) One scenario with surrounding confidence interval based on probabilistic/stochastic methods
- ( ) Several scenarios/variants based on deterministic methods (please specify below the number of scenarios/variants)

Please specify the number of scenarios/variants or provide comments:

10. Please specify what level of detail is disseminated for age:

Single years of age, until age:

Five-year age groups, until age group:

11. Please specify what level of detail is disseminated for year:

- ◯ Single years
- ◯ Every 5 years
- ◯ Other (please specify below)

Please specify or provide comments:

12. In your disseminations, did you use the term(s):

Indicate all that apply.

- ☐ Projection (please elaborate below why)
- ☐ Forecast (please elaborate below why)
- ☐ Other (please specify below and elaborate why)

Please elaborate on choice:

13. Referring to the term(s) selected in the previous question, do you define this term(s) in your disseminations?

- ◯ Yes
- ◯ No

14. In your disseminations, did you use the term(s):

Indicate all that apply.

- ☐ Scenario (please elaborate below why)
- ☐ Variant (please elaborate below why)
- ☐ Other (please specify below and elaborate why)

Please elaborate on choice:

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## DISSEMINATION APPROACH

15. Please indicate the approximate percentage devoted to the following elements in your disseminations:

if other please comment in the next question

Information about the current demographic context/trends:

Information about the assumptions:

Information about the methodology:

Information about the quality of the underlying data sources:

Analysis of the results:

Other (please specify in next question)

16. Comments on *other* specification in the previous question:

17. What information was disseminated in regards to projection outputs or results?

Indicate all that apply.

- [ ] Pre-defined data tables
- [ ] Customizable database
- [ ] Written summary/highlights of results
- [ ] Detailed written analysis of results
- [ ] Visual description of results (graphs)
- [ ] Other (please specify below)

Please specify or provide comments:

18. As part of your dissemination process, did you present the results of your projections:

Indicate all that apply.

- [ ] In press releases
- [ ] In press conferences
- [ ] In external professional meetings
- [ ] In scientific conferences
- [ ] Upon request
- [ ] Never
- [ ] Other (please specify below)

Please specify or provide comments:

19. Upon request, would you distribute detailed parameter/input data to allow users to reproduce the projections, or similar projections:

For example age specific fertility rates.

- ◯ Yes
- ◯ No
- ◯ Don’t know

Comments (optional)

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## COMMUNICATION - CONSULTATION

20. Please indicate which of the following bodies you consulted during the production of the projections, if any, and for what purpose(s) did you consult them:

Indicate all that apply.

| | To develop assumptions and/or methodologies | To obtain feedback about assumptions (though you keep the final word on the assumptions) | To obtain feedback about assumptions (to which you must comply) | To inform them in advance of the official projection release with a primary focus on results | To inform them about the status of the production | NOT consulted |
|---|---|---|---|---|---|---|
| Senior management within the NSO | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Other units within the NSO | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| National government agencies | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Sub-national government agencies | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| International statistical agencies | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| International bodies (e.g., international experts group) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Expert advisory group/panel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Frequent projection users, private sector | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Academic researchers other than formal expert panel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Other (please specify below) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

Please specify or provide comments:

21. If you consulted any bodies during the production of the projections, were these consultations noted in disseminated products?

- ◯ All of the consultations were noted
- ◯ Some of the consultations were noted
- ◯ No, the consultations were not noted
- ◯ Not applicable (there were no consultations)

Comments (optional)

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## INTERACTION WITH USERS

22. Do you have some measures of usage of the projections?

Indicate all that apply.

- [ ] No
- [ ] Yes, electronic web hits/page views views/downloads
- [ ] Yes, other (please specify below)

Please specify or provide comments:

23. Can you identify the major users of your projections?

- ( ) No
- ( ) Yes, all of them
- ( ) Yes, some of them

24. Please indicate the major users:

Indicate all that apply.

- [ ] Government agencies
- [ ] General public
- [ ] Business/industry
- [ ] Media
- [ ] Academia
- [ ] Other (please specify below)

Please specify or provide comments:

25. Can users receive technical assistance on projections matters? (for instance, technical explanation)

- ( ) Yes, they can directly contact the projection makers
- ( ) Yes, mediated by some user support service
- ( ) No

Comments (optional)

26. Are users explicitly informed of the availability of this technical assistance in dissemination products?

- ◯ Yes, in all dissemination products
- ◯ Yes, but only in some dissemination products

27. What are the most common requests for technical assistance that you received? Please elaborate:

For example, if most requests relate to methodological issues, what are the most common methodological issues requiring further explanation?

28. Can you provide approximately in which proportions these requests come from the following category of users?

Leave blank if unknown

| | |
|---|---|
| Government agencies: | |
| General public: | |
| Business/industry: | |
| Media: | |
| Academia: | |
| Other (please specify in following question): | |

29. Please elaborate on *other* if used in the previous question:

30. In your opinion, which initiatives or strategies for *communicating population projections* (including results and methods) to users have been most successful for your institution?

31. In your opinion, which aspects of your projection publications would your users like to see expanded or improved, if any?

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## COMMUNICATION OF UNCERTAINTY

32. In your disseminations, did you use any of the following methods to communicate the uncertainty of projections to users:

Indicate all that apply.

- [ ] Analysis of historical variation
- [ ] Expert judgment elicitations
- [ ] Analysis of past projection errors
- [ ] Creation of multiple deterministic scenarios
- [ ] Use of Bayesian reasoning
- [ ] Use of probabilistic/stochastic approaches
- [ ] Sensitivity analyses
- [ ] Cautionary/instructional note on the uncertainty of projection results
- [ ] Conditional phrasing (e.g., 'would' instead of 'will'), please specify:
- [ ] None
- [ ] Other (please specify below)

Please specify or provide comments:

33. In your opinion, which initiatives or strategies for *communicating the uncertainty of population projections* to users have been most successful for your institution?

34. In your opinion, what challenges do you encounter in*communicating the uncertainty of population projections* to users (for instance, do projection users have any common misconceptions about the projections)?

35. **End of the questionnaire**

Thank you very much for your participation. If you want, you may provide below any comments on the survey, in particular if you found any problems in understanding the questions, or providing the answers, or if you would like to provide additional information on any of the questions.

Paolo Valente
UNECE Statistical Division
on behalf of the UNECE Task Force on Population Projections